THE

ELECTRICAL REVIEW.

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ELECTRICAL REVIEW.

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STREET LIGHTING.

THE interesting paper read by Messrs. Pearce and Ratcliff before the Institution of Electrical Engineers, at four centres, brings before us again the conflict between the gas and electricity departments of the Manchester Corporation, a Titanic struggle which has raged more or less fiercely for 20 years. Seeing that some corporations owning electricity supply undertakings, but not gas works, have been known to favour electricity for street lighting even when an unduly high price was charged for it, we are not disposed to reproach the Gas Committee for retaining the street lighting in its own hands as long as possible; but we have no doubt that the citizens of Manchester have paid, not only in money, but also in time, convenience and reputation, many times over for the questionable privilege of gas-lighted streets, and the fact that their great city is universally shunned by all who can contrive to do their business elsewhere is probably due in great part to the funereal gloom with which its streets have become firmly associated in the minds of its visitors. It should be borne in mind by those responsible for lighting parks, and other public decorations or ornaments, that a city develops a "character" just as truly and inevitably as an individual; it may be a good one or a bad one, cheerful or gloomy—but whatever it be, the mental impression is linked with the very sound of its name, and traffic is diverted towards or away from it according as the impression is attractive or the reverse. It is the duty of the public representatives to remember all these things, and to lose no opportunity of improving the character and raising the status of their community. Fortunately for Manchester, the Corporation has at last realised the futility of expecting impartiality and altruism from a Gas Committee, any more than from an Electricity Committee, and has appointed a new Street Lighting Committee to deal with the subject without bias towards either illuminant, seeking only the best results for the benefit of the public.

The authors in their paper (of which we commence an abstract in this issue) give data which amply justify the report of Mr. Haydn Harrison on the same subject, abstracted in our issue of November 1st, 1912. It will be remembered that Mr. J. Abady, who carried out tests at the same time, also agreed that the gas lamps were giving an illumination far below their rated candle-power, and that electric lighting came out the cheaper; he held that the efficiency of the gas lamps could be greatly increased, but if so, why was it not done? The Gas Department had as free a hand as the Electricity Department; "each was to do its best," say the authors, and the result is an emphatic and unanimous verdict for the flame arc.

While we hail this result with satisfaction—though it is no more than we expected—we may point out that by no means the last word has yet been said on the subject of the arc lamp for street lighting. In point of fact, by their

careful tests the authors have revealed defects in the ordinary design of shades or reflectors and globes, and have shown that these may have a very marked effect upon the uniformity and efficiency of the illumination obtained. In passing, we are inclined to regret that they have imported into a subject already sufficiently complex and involved a new factor—a suggested standard height of 5 ft. for these measurements; the proposed international standard is one metre, which is in general a very convenient height and enables results to be compared with greater confidence than when they have to pass through a conversion process beforehand. Even yet, it appears, the authors have not completed their investigations, but it is clear that certain definite conclusions can be drawn from the work already done—the central suspension is to be preferred; partially frosted globes are practically as effective as dioptric globes; and flame arc lighting has nothing to fear from high-pressure gas lighting, either on the score of cost or on that of uniformity of illumination.

The authors have also demonstrated very plainly the primitive condition in which the design of arc lamp globes remains, and the remarkable improvements that can be effected by simple means; it is surprising that greater attention has not been devoted to this subject by the makers, for the requirements of lamps for street lighting have been understood for many years. No doubt, in view of the results set forth in this useful paper, suitable changes will be quickly effected, doing away with the drawbacks in question.

The German Electrical Industry in 1912.

According to the report of the Association of Electrotechnical Special Works, which claims to represent practically the whole of the industry apart from the three or four huge undertakings, the year 1912 was favourable to the special works, which were again able to secure an increase in the turnover. This was accomplished without any corresponding addition to the number of workmen, as the improvements introduced in manufacturing enabled the firms to satisfy the greater requirements. The course of business was chiefly stimulated by the erection of overland stations, the large demand experienced from industrial establishments, and the rapid extension of electric lighting in private dwellings. Nevertheless, the financial results did not always keep pace with the volume of trade, this being due to the sharp advance in the prices of copper, brass, lead, porcelain, &c.; and the extra charges which some branches impose as a condition in connection with contingent rises in the cost of materials, were only able to offer partial compensation. Concerning the larger turnover in 1912, it is mentioned that this principally applied to the domestic market, the export trade participating to a lesser extent. The exports to Italy suffered from the effects of the war in Tripoli, and those to the Balkan States from the war in that region. It is considered in this connection that the German firms must make still greater efforts in order to be able to meet the native electrical works, rapidly developing under the protection of high import duties in Italy, Austria-Hungary, Russia, and in the Scandinavian countries in general, and Sweden in particular.

After these general observations the report proceeds to deal with the different branches of the industry. In the case of electrical machinery, the interested works all experienced good sales. Unfortunately, however, the extra charges made for rises in materials were only applicable to types of over 5 H.P., as the large firms excluded the smaller machines, which are of great importance to the special works, from any improvement in prices. The cable department was satisfactory, as the effects of the cable syndicate guaranteed the obtaining of profitable prices, although the level of prices was depressed in many cases by the operation of foreign competition. With reference to the very unfavourable rates realised in 1911 for insulated wires, the report points out that an improvement in this direction was effected in the spring of 1912 by the formation of a price convention, whilst a price syndicate for insulating tubes, the manufacture of which had long been unremunerative, was also constituted towards the end of 1912. On the other hand, the department for meters continued to suffer from inadequate prices, especially owing to the endeavours of the large firms to obtain possession of the supply works of communal authorities.

A slight improvement took place in the arc lamp branch. It was found possible to relieve to some extent the pressure exerted through the operation of the tax on lighting appliances by the introduction of new types of arc lamps having a longer lighting duration, although the tax continued to render business in arc lamps difficult in the home market. The competition of high candle-power metallic-filament lamps, which had unfavourably influenced the arc lamp trade until a short time ago, seems to have reached a parting of the ways, as it is shown that arc lamps still offer undisputed advantages over wire lamps in many cases. The glow lamp department also continued to labour under the disadvantages of the lighting tax; not only on account of the difficulties which the tax causes to the works, particularly the small glow lamp factories, but also because of the exceptional injury which has recently been inflicted on the export trade. In explanation of this remark, it is stated that both the United States and Canada have now for some time past included the glow lamp-tax in the German market value, which is based upon *ad valorem* duty, so that the rates of duty on glow lamps of German origin have been increased and have a prohibitive effect. The manufacture of measuring apparatus suffers from the depression in prices caused by the erection of new works of small size, and the makers of apparatus for heavy currents and of installation materials also complain of unfavourable prices, especially for staple articles. In conclusion, the report refers to the continuance of the monopolistic efforts put forth by the large manufacturing establishments.

Steam Raising Extraordinary.

It has often come within our province to deplore the ignorance of the ordinary newspaper writer, as exhibited whenever he has had to describe any mechanical contrivance, or otherwise enter upon engineering ground. Of late years some of the daily papers have professed to run an engineering page or two every week. But some of the effusions which grace the engineering columns of the daily Press are painful to read. In the *Standard* of March 11th, for example, there is what purports to be a description of a new system of boiler feeding which preserves the water-level constant. We are not finding fault with the appliance, for, to begin with, the description of it is too meagre to enable either praise or blame to be awarded. But we do object to the verbose, bombastic language of the article. A steady feed is desirable, but its attainment is not a novelty. There are many ways by which it has been, and may be, attained. But reasonable and small variations of water level are not accompanied by those horrible symptoms of engineering indigestion which our daily contemporary works up into a veritable witches' cauldron of disease to be exorcised by the engineer, surgeon or physician. These appeals to human ills and the medical profession, as applied to engineering matters, are out of place.

Engineers who read these florid and overdrawn descriptions are prone to disregard even the good things to which such misplaced language may have been applied. The daily Press should surely be able to secure the services of writers who, with a knowledge of technics, combine the ability to employ plain and simple descriptive language when dealing with mechanical subjects. We have all long ago sickened of the "extraordinary," the "revolutionary" and the "unprecedented" by which some writers think to goad up public interest in even the most trivial of improvements or the worst forms of perpetual motion.

NEW TYPE OF TRAMCAR.

The new type of tramcar, illustrated herewith and now in use in New York, offers several interesting features, among which attention may first be called to the very low platform level secured by the use of the special bogie-trucks shown in fig. 2. From the passenger's standpoint, this alone is a most important innovation, and one which is confidently expected to reduce considerably the present annual number of accidents occurring when mounting or descending from cars.

The longitudinal members of the car framework must generally be about 1 m. above street level, over the wheels, in order to clear the latter, but there is no reason why the chassis should not be sunk between the bogies, and this has now been done, as shown in fig. 1.

The new car is carried by a bogie (with one motor and one trailing axle) at each end, passenger doors being arranged at the centre of each side of the vehicle. The side frames of the bogies and the side members of the chassis are so arranged that the floor of the car is as low as possible

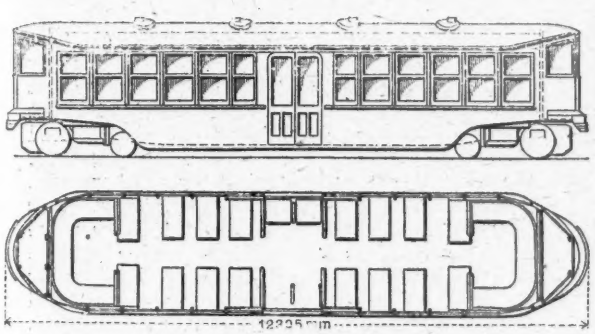


Fig. 1.—New Type of Tramcar.

while permitting free rotation of the bogies on curves of 40 ft. radius. The driving cabs are elevated and partitioned off from the remainder of the car. The leading dimensions of the new cars, which seat 51 and provide standing room for 32-40, are as follows :—

Length over buffers	41 ft.
Length between end partitions	34 ft.
Overall width	8 ft. 3 in.
Overall height above rail	9 ft. 6 in.
Height of step (passengers')	10 in.
Height of floor in body of car	1 ft. 4 in.
Height of floor in driver's cab	2 ft. 8 in.
Internal height of car	8 ft.
Minimum height above rail	7 in.
Width of double side doors	3 ft. 10 in.
Distance between bogie centres	29 ft.
Distance between axles	5 ft.
Diameter of driving wheels	2 ft. 6 in.
Diameter of trailing wheels	1 ft. 7 in.
Net weight of chassis	6·25 tons.

The transom of each bogie is mounted on inverted springs hung from the side frames of the truck, and a Westinghouse motor is mounted on each driving axle.

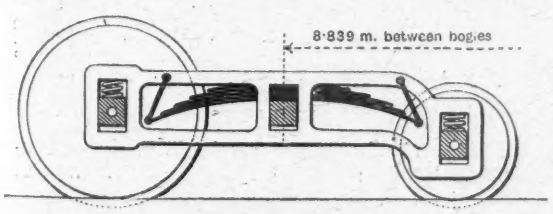


Fig. 2.—Bogie of New Car.

The floor of the car consists of an angle-iron framework held by transverse angle-irons, to which are riveted the 3-mm. side plates. The principal cross-beams are 152 × 89/17·5 mm. and the joints to the longitudinal members are stiffened by riveted plates. The cross-beams are bent to suit the depressed floor of the car, and are connected to the buffers by double Z-irons. The latter, which are also bent to pass over the motors, carry the bearings for the bogie pivots.

The side doors are moved in or out of the recesses shown by pneumatic gear controlled by the conductor, who is seated on an elevated bench at the rear of the car. Eight top ventilators each provide the air supply requisite for ten passengers. The opening of the ventilators is automatically controlled by the car springs, so that the air supply is always proportioned to the number of passengers on board. In summer, additional ventilation is provided by opening the lower part of the side-windows. Electric heating is provided, when required, chiefly by the controller rheostats.

REVIEWS.

Poems. By E. L. Hill, M.I.Mech.E., A.M.I.E.E. London: The *Electrician* Printing and Publishing Co. Price 2s. 6d. net.

That an engineer may be an artist we know; but it is rarely that he breaks out into poetry, and when he does, we usually wish he didn't. But there are exceptions, and we are glad to include amongst them the author of this little book. Although a mechanical and electrical engineer, Mr. Hill does not drag technicalities into his poems; these are simple, and often touching, and though they are not highly finished, they bear the stamp of true and earnest sympathy with life. Some slight deficiencies of composition and punctuation may well be excused in view of the admirable sentiments which the author has embodied in his verses.

A Primer of the Internal-Combustion Engine. By H. E. Wimperis, M.A. London: Constable & Co. 1913. Price 2s. 6d. net.

This little book is intended for the use of students in their first or second years of study. It is well arranged, and commences with a table of useful constants with their initial abbreviations. Both British and metrical equivalents are given, and we welcome the metrical equivalent of the United States gallon, for it is too little known that the United States gallon is only about four-fifths the capacity of our 10-lb. imperial gallon, ignorance of which fact has, to our knowledge, worked injury to British interests. Some Americans are cute enough to sell, say, a 1,000-gallon article and let their motto be *Caveat Emptor*—Mr. Emptor buying the large number of gallons in ignorance of their less cubic measure.

But we must quarrel with Mr. Wimperis over his use of the bastard C.H.U., which, being interpreted, is the number of heat units per pound per degree Centigrade. Useful it may be, for we have seen it used in a report in such a way as to deceive the unwary. It is a constant which ought not to be allowed, and if, as may happen, an engineer may need to use a Centigrade thermometer when working with pounds, he ought to translate his results into one or other system, and not use such a likely deception as the Centigrade pound heat unit. The calorie and the B.TH.U. are sufficient.

The author gives a brief historical *résumé* of the gas engine, and gives credit to Beau de Rochas for the invention of the so-called Otto cycle. It still puzzles many people to know how Otto could uphold his patent in face of de Rochas' earlier patent. But de Rochas was not the only gas engine inventor who did not profit from his invention, for Clerk, who invented the two-stroke engine, has only had the satisfaction of seeing it adopted in some of the best modern engines. Daimler and Diesel complete the history to date. There is a very brief section on fuels, after which comes Chapter II, an excellent chapter, only marred by the C.H.U. Why not have introduced the F. Calorie while on the job of multiplying these units?

Chapter III is a good exposition of the laws and properties of gases, especially the note on volumetric heat, so useful in gas-engine work.

The author describes entropy as a quantity which cannot be directly measured or simply defined. As a definition of entropy useful to the engineer whose ideas are usually

tied up to the P.V. diagram, we would suggest that entropy be defined as length on a diagram of energy of which the ordinates are temperature; just as the ordinary indicator diagram is defined as an energy diagram of which ordinates are pressure and length (or abscissæ) is volume. This definition is really that given in this book at p. 34.

Chapter IV and V deal respectively with the ideal and the real engine, with its various mechanical details, but as in so many books, when the exhaust valve opens the gases lose their interest just where, in practice, they begin to give trouble and make themselves heard. When will the author arise who will tell us something of silencing and show how to silence an engine without loss of work? The author treats of the horse-power rating of petrol engines, but does not indicate what is the mean pressure on which ratings are based. Nor is the rotative speed named.

Fuels are treated more fully in Chapter VI, as well as gas producers, engine details in Chapter VII, and testing in Chapter VIII.

As a student's book, this is very good and clear.

Winding Engines and Winding Appliances. By Messrs. McCulloch and Futers. London: Edward Arnold. Price 21s. net.

As mines deepen, the problem of winding becomes more important. The output of a coal mine is measured by the quantity of coal that can be raised at the shaft rather than by the capacity of the miners to get the coal. As mines deepen, the amount that can be raised per day must be reduced unless there is a corresponding improvement in winding efficiency. Winding involves the starting of a heavy load from rest, and its acceleration to, say, 2,000 ft. per minute, with final reduction to rest, also without shock.

Fortunately, for deep mines, the maximum speed can safely be higher than for shallow depths. Thus, any lift may be divided into three parts—acceleration, steady running, deceleration. The two end periods may be alike for deep and for shallow pits, but the middle steady run will be longer for deep pits, though not proportionately longer. A pit of 400 yards is wound, let us say, in half a minute. If it were 1,400 yards deep, there would be an additional 1,000 yards' run at maximum velocity, and if a maximum velocity of 1,000 yards per minute were allowed, this extra depth would demand 1 minute nearly, or a total time of 3 to a depth ratio of 3½.

The authors introduce the reader to the few main systems, including the cylinder drum, the cone drum, the flat rope, the combination cone and cylinder, the tail rope, and the Koepe systems.

All mine winding is based on the same principles; but in colliery work there is the advantage of long periods of work from one depth, whereas in a gold mine there are frequent changes of depth.

In winding the first requisite is the rope, which we are told had better be worked to death, and often replaced, than made heavy and lasting, for the rope is easily the main load in a deep mine; and the less its weight the less must be all other costs. This applies more especially when depths exceed 1,000 yards. Usually a factor of safety of 7 to 10 is employed. Thus in a 1,000 yards' pit the rope and its load will weigh close upon 5 tons if 1-in. diameter, and it will break at 45½ tons if of plough steel of 110 tons tenacity. Here the actual factor of safety is about 9. With a factor of 7 the rope would be only 0·835 in. diameter, and its weight 3,620 instead of 5,300 lb. For the first case a torque of 15,338 lb. is required. The authors work out the moments and negative moments with reference to the danger of over-winding, and so arrive at the heavily stressed rope and conical drum for deep mines, and more especially at the tail rope, whereby moments are kept statically equal. But the tail rope is limited to about 2,600 ft., because of its liability to sway and whip.

In their consideration of these various types of winding systems, the authors show themselves to be unbiased, pointing out the defects of all alike as well as the advantages, and thus greatly helping a mining man to select the best for any particular case. On the subject of electric winding, the authors see little in it on the basis of economy, as compared with direct steam winding, partly owing to the amount of machinery necessary. But they do realise that electric winding with its regular speed minimises the tendency to dancing the cage and thereby seriously reduces the rope stresses. Is not this factor alone one of major importance in a process which is limited really by rope stresses? In any case, they condemn the conversion of old winders to electrical driving, for this plant must be new throughout. But with transmitted power from a central station for all purposes, electrical winding must surely be adopted. Yet the authors are not even sure on this point. The drum of an electrical winder may be a cylinder, thus saving the cost of the cone drum, for the difference of moment matters less to an electric motor with a powerful source to feed it.

Then tail ropes may be used to a greater depth than in the case of steam winding, for the rope surges less. Also speeds may be higher, which is an important item in deep mines, and though in the multiplicity of gear there is risk, experience does not seem to show such risk to have been great.

If the book has a fault it is that the authors see so far round all sides of every system that the reader is faced about from page to page.

Various examples are given of winding gears, electric and otherwise, with very full particulars, and in arguing out systems actual figures are used and very little mathematics.

Old belting and sheet lead are advised as a better facing for a brake than wooden blocks, but the belts must be of rubber, not of balata. And post brakes are better than hand brakes. Pit sheaves, if lined with wood, should not be done at home and exported. They should be done locally from indigenous timber. This is a practical point doubtless picked up in dry Australia, where imported articles of timber so seriously shrink on exposure to the parched atmosphere. Safety gears against overwinding on the illness of the engineman are described, and a special chapter is given to ropes, and is very good. Then there is a chapter on cages and safety hooks, &c., and guides, and another on cages and decking in coal mines. The whole is a thoroughly sound and practical treatise on the subject of winding, a subject of increasing importance, as mines become deeper and low-grade propositions become more common, for these require such a heavy winding tonnage to bring up with the pay stuff so many tons of dirt.

La Télégraphie sans fil, la Télémécanique, &c. By E. Monier. Paris: H. Dunod et E. Pinat. Sixth edition, revised and enlarged. Price 2 fr. 50 c.

This edition has been supplemented to bring it in accordance with more modern practice. Among the additions are descriptions of the uses which may be made of radiophares or shore stations giving directive transmission to enable ships to obtain their bearings and distances; methods of transmission giving musical notes; wireless telephony, &c. A special chapter is devoted to a description of the important Eiffel Tower station. Branly's method of producing mechanical results at a distance by means of Hertzian waves still forms a main feature of the work, but no special advances in this direction are recorded. They appear to be still very much in the air. Numerous other possible applications of electric waves are suggested, the author being evidently of a very sanguine turn of mind.

Wireless Telegraphy for Amateurs. By R. P. Howgrave-Graham. London: Percival Marshall & Co. Revised edition. Price 2s.

This interesting and useful little work for amateurs has been somewhat extended and improved since its first appearance.

The first two chapters are devoted to the outlines of the history and theory of wireless telegraphy, while the remaining chapters mainly concern practical methods so far as they are desirable for the amateur. In regard to the former part, the author is inclined to lay too much stress on absence of tuning in the early forms of Marconi transmitters. The earliest Marconi aerials consisted of elevated capacity areas which undoubtedly gave efficient syntonic transmission, but the receiver was not adapted to make effective use of the

syntonic properties of the transmitter. Such aerials will ordinarily emit trains of waves with quite small damping, though there may be a weakness in selective properties arising from their tendency to produce shock excitation.

A point of criticism in regard to the efficiency of quenched spark transmitters may also be usefully referred to. The overall efficiency is said to be about 75 per cent., as against 25 per cent. for the unquenched spark. Possibly this is a fair statement so far as the production of energy in the aerial is concerned, and it is one which is commonly made. It does not follow that the radiation efficiencies are in this proportion, since the dissipative factor is made up of a radiative and a non-radiative part. The ratio of these two parts may be quite different in the two cases. The point is one which demands considerably more investigation than has yet been given to it.

On the whole the book is well suited to young amateurs, to whom it should prove a helpful acquisition, both from its simplicity and from its interest.

Magneto and Electric Ignition. By W. Hibbert, A.M.I.E.E. London: Whittaker & Co. Price 2s. net.

The author, who is the head of the Physics and Electrical Engineering Departments of the Regent Street Polytechnic, has already written a book entitled "Electric Ignition for Motor Vehicles," but, in view of the way the high-tension magneto has practically displaced all other forms of ignition on automobiles, he has deemed the time appropriate to produce an entirely new work on the subject, on which, on the whole, he is to be complimented. He has set out with the object of endeavouring to impart to the ordinary non-technical motorist some idea of what goes on in connection with the production of the spark, the vagaries of which, in the early days of the motor movement, were the cause of much worry and anxiety, but which, in the hands of experts, has in modern times been so tamed as to behave with wonderful regularity, and, given a modicum of attention, with a minimum of trouble.

The introduction, which extends to 30 pages, will repay careful study, as Mr. Hibbert, in the method adopted of explaining the fundamental principles, has been very happy, his definitions being clear and striking, notably those explaining the difference between "electricity" and "a current of electricity," and his comparison of the human heart and its influence on the circulation of the blood, with the production of a mechanically-generated current of electricity and its distribution, most apt. Following the introduction is a description of a number of the best-known magnetos at present on the market, such as the Bosch, Eisemann, Simms, C.A.V., Mea, and Fuller. This section is useful so far as it goes, but if a motor-cycle type of magneto had been included, the book would probably have appealed to a much wider circle of readers.

Another useful chapter is that devoted to "gearing"; this deals with the relative speeds of magnetos and engine crankshafts, the firing sequence for motors with from one to eight cylinders and cranks being given, accompanied by diagrams. Seeing that, so far as motor-cars are concerned, the type has long been obsolete, the firing sequence of three-cylinder engines might, perhaps, have been advantageously replaced by that for the V-type of twin-cylinder motor now being largely used on cycle-cars. There is a good deal of other information in the book, which, while instructive to an extent, will not prove of much value to modern motorists and motor-cyclists, as, for instance, the description of low-tension magnetos with make and break inside the engine cylinders, a method which is no longer used on automobiles. A similar remark applies to the 40 pages (out of a total of 152) devoted to "Ignition by Battery and Coil," and "Faults in Cells," although the latter may serve a useful purpose to those owners of cars that have electric lighting installations fitted. The last chapter deals with dual or combination-ignition systems, with a brief reference to the Delco electrical arrangement for engine starting, lighting and ignition, as employed on the Cadillac cars. The promising future for arrangements of this kind—several new ones have lately been introduced—renders it desirable to embody as early as possible as much information as can be given of the different systems, and of the points that need care and attention, and this section will doubtless be extended in the next edition.

Apart from the few points we have criticised, Mr. Hibbert's book leaves a good impression, and can be well recommended to motorists, particularly to those who drive and look after their own cars.—C. J. W.

Applied Electrochemistry. By M. de Kay Thompson, Ph.D. London: Macmillan & Co., Ltd. 1911. Price 9s. net.

This book, unlike existing text-books treating of special branches of the subject, covers the whole field of applied electrochemistry and electrometallurgy, and, on that account, should prove very useful to students unable to consult a whole range of books or the original sources. Its special feature is a theoretical discussion of the scientific principles of each process before giving the description of the process as realised in practice, so that the closest possible connection is maintained between theory and practice, to the obvious advantage of both. A sound knowledge of chemistry is rightly assumed; a person with only a smattering of chemistry is in a position neither to understand nor to work efficiently modern electrochemical processes.

As already stated, the book covers practically the whole field of the subject, but the treatment accorded to the various branches is very unequal. Thus, while the chapter on the electrolysis of alkali chlorides is admirably clear and well covers the ground both on the theoretical and the practical sides, that on electroplating is so thin and superficial as to serve hardly any useful purpose. To a less degree this applies to other chapters in the book.

In the chapter on electrometallurgy of iron and steel there is no reference to the important subject of ferro-alloys. We think, moreover, that more attention should have been paid to the pure metallurgy of the subject. It is very strange how little it is realised, even by many practical electro-metallurgists, that an electric furnace is primarily a metallurgical apparatus, and it is on its merits as such, rather than on its electrical efficiency, that it will succeed or fail. Neither here nor elsewhere is sufficient stress laid on the all-important question of costs, which, in our opinion, should be brought before the student at the earliest stage of his technical career. If the simple principle were borne in mind that a new process will succeed not on account of its beauty, but because it does something more cheaply or better than it has been done before, the world would be spared much wasted effort and ill-spent invention.

In spite of these undoubted limitations, which, as a matter of fact, are unfortunately the common faults of nearly all technical books, Dr. de Kay Thompson has given us a very well-written and a very comprehensive text-book on a subject that is most difficult to write about both clearly and soundly. He has avoided most, if not all, of the pitfalls that abound, and his book is a welcome addition to the still scanty English literature on a subject which is every day becoming more and more important.

Electric Arcs to Ignite Tunnel Gases.—Large quantities of gas were encountered during the cutting of the aqueduct tunnel through the Santa Ynez range (California) for the water supply of Santa Barbara, and in order to dispose of this inflow, electric arcs were used to ignite the gas after firing shots in the heading. Specially designed open lamps were placed about 200 ft. apart in high points along the tunnel up to 150 ft. from the heading. Half an hour after blasting the arcs were switched into circuit (an ammeter at the switch indicating whether the arcs lighted or not). After switching on the lamps controlled from the tunnel mouth, the foreman and a mate advanced to another arcing station 3,500 ft. from the portal, and again switched on current. If no gas explosion occurred, the tunnel ahead was explored with safety lamps, and if no "pockets" were discovered, the inspectors returned to the in-bye station, switched the arcs into circuit, and, leaving them alight, proceeded to the heading and placed torches at intervals of 100 ft. through the gas section. These torches were kept burning during the next shift, and four hours were occupied in testing before a heading gang was allowed to go on shift after blasting had been performed; apart from these testing intervals, work was continuous. The completed tunnel is 19,560 ft. in length.—*Electrical World.*

CORRESPONDENCE.

Letters received by us after 5 P.M. on Tuesday cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

The Electro-Harmonic Society.

I was very pleased to read your footnote to the letter which appeared in your issue of March 7th. In order to anticipate criticism of my remarks, I will state at the outset that I smoke, drink, go to Bohemian concerts and am a Democrat—all in reason. But (and this is important) just as the strength of a chain is that of its weakest link, so the tone of any assembly is determined by the laxity of its rules.

Now I do not wish to say too much about what is, obviously, a delicate matter; but one of the privileges of belonging to the E.H.S. which a social or financial junior enjoys, is that he mixes with the seniors of his profession or industry. Once introduce smoking, and drinking will surely follow. Even then no harm would be done if all the members were seniors—but it is not necessary to push my argument to its logical conclusion. Suffice it to say that the majority of members, who like the present high tone of the E.H.S., and who can be in a lady's presence without feeling the necessity to smoke—would either resign or cease to bring their womenfolk.

Whilst it is true that we must move with the times, music halls and cinemas have not superseded theatres and concert halls. Similarly, Bohemian concerts need not supersede our ladies' nights, and those who prefer the former exclusively will find plenty of opportunities to gratify their taste.

Member, E.H.S.

Electric Branding.

I should be much obliged if you could assist me, through the medium of your paper, in finding some manufacturer who has had experience of electrical heating of large-size branding machines for marking wooden box sides; the maximum overall sizes of the branding would be 3 ft. × 2 ft.

Any assistance that you could give me in this matter would be very much appreciated.

H. A. Nevill,
City Electrical Engineer.

Wakefield, *March 13th*, 1913.

Morse Signalling on Submarine Cables.

As a sequel to Mr. E. Raymond-Barker's article on Mr. Gott's discovery, and the observations made thereon by Mr. P. O'Neil and Mr. Fraser, will you give me leave to recall to the mind of your readers a telegraphic system of old date, viz., "The American Rapid Telegraph," patented by Messrs. Foote, Anderton and Randall, and described in some technical papers about the years 1879 or 1880. I, at that time, experimented with this system and was very much impressed with a most ingenious mechanical apparatus, invented to prepare the perforated slip, by means of which the currents were sent and changed in direction at each consecutive signal. Nevertheless, however great may have been the ingenuity of this mechanism, I do prefer incontestably (at least on lines with a return current) the method devised by Mr. Gott for realising this part of his discovery. It is not only as simple as it is elegant, but, above all, more *electrical*, sure, and much less expensive.

If I were not afraid to abuse the hospitality of your columns, I would add another souvenir: 25 years ago, an Italian inventor, the late Marquis Tommasi, had contrived a secret arrangement which appeared to me to be founded upon the same principles. His apparatus were locked up in a closed box, because intended for military purposes by Marquis Tommasi, who was convinced of the impossibility for a spy to decipher the signals fraudulently obtained either by means of a derivation, or otherwise—therefore, he was extremely amazed when I presented to him a correct slip obtained in such a manner with the help of two parallel polarised relays and a Morse inkwriter, and he left very politely, but without further explanation concerning his invention.

F. Godfroy, *Manager,*
Compagnie Française de Cables Télégraphiques.

Brest, *March 10th*, 1913.

The "Load-Factor" Question.

In fixing yearly contracts for the supply of current to factories, &c., on a load factor basis, I shall be glad to have the opinion of some of your readers as to whether the time element should be for, say, a certain number of days, the number of days run × 24, or the actual hours run by the factory.

Consumer.

LEGAL.

Tramway Accident Claims.

A road accident, in which the driver of a phæton, named Frederick William Betts, was seriously injured, was the subject of an action in the King's Bench Division, on Wednesday, March 12th. The L.C.C. as owners of the electric tramways, and Mann, Crossman & Paulin, Ltd., the owners of a motor lorry, were the defendants. On August 12th last the plaintiff was driving his employer's phæton in the High Road, Streatham, when the brewers' lorry, while passing the tramcar, was struck on the hub of his wheel. The blow caused the lorry to swerve and collide with the phæton, throwing the plaintiff out and pinning him against the wall, causing injuries from which he still suffers. The injury was not disputed, and the only question for the jury who tried the case was whether the tramcar or the lorry was to blame. A large number of witnesses were called by both the L.C.C. and the brewers, each of whom tried to cast the blame on the other, and in the result the jury found for the plaintiff, as against the L.C.C., assessing the damages at £300, and for the defendant in the case against Mann, Crossman & Paulin.—Judgment was entered accordingly.

A Court of Session action has been settled in which a vanman claimed payment of £500 as damages for personal injuries from Glasgow Corporation. While driving a van he was run into by a tramway-car. A payment has been made by the Corporation, which the pursuer has accepted, of £65 and expenses.

Sheriff Umpherston heard proof in the Sheriff Court in three conjoint actions against the Dunfermline Tramway Co. for damages in respect of personal injuries. Pursuers were a miner and an engineman and his wife, who were passengers. They each claimed £100. It was their contention that a car was being driven at such an excessive and dangerous rate of speed that it failed to negotiate a loop, and, jumping the metals, ran into an embankment. Defenders, on the other hand, stated that the car left the rails through some obstruction on the line, and that it was almost immediately thereafter pulled up by the driver. The driver, they state, drove cautiously and carefully while approaching the crossing. The hearing was adjourned.

The National Telephone Co., Ltd., *v.* H.M. Postmaster-General.

The Court of Appeal on 14th inst. decided to hear the appeal and cross-appeal from the decision of the Railway and Canal Commissioners respecting the purchase, on April 15th.

Dispute about an Accumulator Shed.

The question whether a shed erected by the Metropolitan Railway Co. in Euston Road to hold accumulators for electric signalling, comes within an exemption of the London Building Act of 1894, although it is erected beyond the building line, was decided on Friday, March 14th, by Justices Channell, Bray and Coleridge in the King's Bench Divisional Court.

Mr. Macmorran, K.C., who appeared for the Metropolitan Railway Co., said his clients had been convicted by a metropolitan magistrate for an offence under the London Building Act. It appeared that they were given power in their Act to erect a ventilator in the forecourts of two houses in Euston Road. That was at the time the trains were run by steam. When the railway was electrified, a system of electric signalling was installed, and the ventilator was removed and an accumulator shed erected. The County Council then alleged that the company had no right to erect the shed beyond the building line without the sanction in writing of the Council, and that they had been guilty of an offence. For the company it was contended that they were exempted by a proviso in their Act of 1866, and a section of the London Building Act. The magistrate, however, decided in the Council's favour. Mr. Macmorran argued that the mere fact that the ventilator was succeeded by an accumulator shed did not

alter the fact that what was erected on the spot was something for the purposes of the railway, and although that was beyond the building line, it was exempted.

After hearing Mr. Daldy for the London County Council, the Court allowed the appeal, with costs, holding that the shed, as it held accumulators for electric signalling, was necessary for the purposes of the railway and was, therefore, within the exemption in the Building Act of 1834.

The Osram Lamp Works, Ltd., *v.* The Yorkshire Incandescent Electric Lamp Co.

In the Chancery Division, on Friday, March 14th, Mr. Justice Swinfen Eady had before him a motion in the above action.

Mr. Lunge, who appeared for the plaintiffs, said that the matter had stood over until that day for the purpose of plaintiffs receiving the defendants' evidence. No reply to his clients' affadavits, however, had yet been received, and he would ask that the matter should be allowed to stand over again for the purpose of complying with a somewhat singular request. Plaintiffs' evidence was exceedingly succinct, and to the point on the question of infringement, but it was suggested that the defendants desired to send to Germany, where the filaments of the lamps in question were made, for the purpose of ascertaining whether there was any infringement or not.

His Lordship: Is it another Osram lamp petition?—Mr. Lunge: Yes.

Mr. Frost, for the defendants, said the filaments of the lamps complained of were made in Berlin by a well-known firm there. The defendants desired to make their evidence stronger, and to get it as complete as possible.

His Lordship: When did you have the plaintiffs' evidence?—Mr. Frost: About a fortnight ago. We have been in consultation with German manufacturers through their agents, and yesterday we reached the stage that they will demonstrate to us the process by which the lamps were made and permit us to take an independent expert with us.

His Lordship asked why the defendants could not file an affidavit stating exactly what the process was. They could surely have done that in a fortnight.

Mr. Frost said they thought their case would be stronger if they got independent evidence by means of experiments.

His Lordship: Never mind the experiments; why don't they show exactly the way they are made? That could easily be done if the gentleman who makes the lamps were to file an affidavit.

Mr. Frost said his clients were very busy communicating with the manufacturers.

His Lordship: Do you mean they are busy making the lamps or making affidavits?

Mr. Frost said they were busy preparing the evidence. The plaintiffs should have the evidence directly defendants had got it themselves.

His Lordship said defendants could easily file evidence showing how the lamps were made; it need not be long.

Mr. Frost: It will not be long, but we wish to make it quite clear that there is none of the mysterious water vapour.

His Lordship: Set out your process in plain English!

Mr Frost: That is what we are going to do.

His Lordship said he would let the motion stand over until the first motion day of next sittings, but the defendants must be ready then or, in the ordinary course, judgment would go.

Watson, Laidlaw & Co. *v.* Pott, Cassels & Williamson.—Appeal.

The Second Division of the Court of Session last Friday disposed of an appeal in the action by Watson, Laidlaw & Co., 93, Dundas Street, Kingston, Glasgow, against Pott, Cassels & Williamson, Motherwell, for interdict against the infringement of pursuers' patent for improvements in centrifugal machines, and for £5,000 damages. Pursuers, having obtained a judgment on the question of infringement, the case was remitted to Lord Dewar to dispose of the question of damages. Defenders lodged a tender of £1,500, and the Lord Ordinary decerned against them for that sum in full of the conclusions for damages, found defenders liable in expenses to the date of the tender, and found pursuers liable in expenses since that date. Pursuers appealed against the finding as to damages. Lord Dundas, in giving the decision on the appeal, held it was fairly established that the loss of profits which the pursuers might have realised, if they had effected all the infringing sales of machines, 252 in number, amounted to very nearly £5,000. Considerable deduction must, no doubt, he made, but his Lordship thought £1,500 quite inadequate, and that the Court would not be treating defenders with any severity, but with some leniency, if it fixed the damages at £3,000. The other judges concurred in this opinion.

Meeting of Creditors.—A meeting of the creditors of Wm. Henry Micklewaite, electrician, of Belmont Terrace, Forest Moor, Knaresborough, and 12, Coronation Grove, Harrogate, was held at York on March 13th. The accounts showed gross liabilities amounting to £214, assets valued at £113, and a deficiency of £101. The estate remains in the hands of the Official Receiver for realisation.

RADIOPHARES NEAR BREST.

When, in time of fog, luminous signals from lighthouses or ships cannot be seen, the risk of disaster on dangerous coasts is enormously increased unless warning code signals are dispatched and received by "wireless" from a coastal station. By noting the intensity of the signals received, an approximate idea of the distance from the sending station can be formed by a skilled wireless operator—particularly if the signals be continuously compared with those from another station situated at a second point on the coast. The installation of a Blondel orientation frame or a Bellini or Artom radiogoniometer on board a vessel enables the bearing of the latter to be determined fairly accurately with regard to two coastal stations. Were every vessel equipped with wireless transmitting apparatus, a more convenient arrangement would be to provide directive aerials at two land stations, thus enabling the latter to

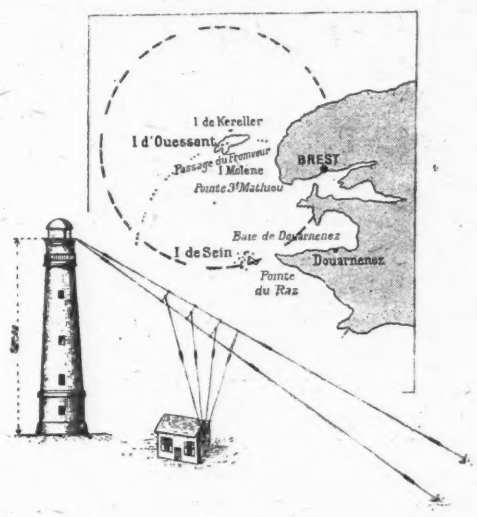


Fig. 1.

determine the bearing of any ship issuing inquiries, and then to communicate the bearing to the vessel. Even the simplest form of radiophare, emitting a pre-arranged code signal but employing and requiring no directive aerial, enables rough bearings to be taken by the navigator of a vessel, and prevents those radical misapprehensions which are so frequently the cause of disaster; the assistance thus rendered, supplements such information as is obtainable by sounding, dead reckoning and by listening for submarine signal bells, and it is more than probable that such radiophares—emitting signals capable of reception by all ships equipped with receiving apparatus costing only a few pounds, and capable of manipulation by any member of the crew—will soon be installed in as great numbers as light ships and houses are at present.*

The French Admin. des Phares has lately installed radiophares at the entrance to the Port of Brest (see fig. 1), the equipment in each station comprising an alternator driven by a petrol or electric motor, an automatic transmitter and a suitable aerial. Referring to fig. 2, showing the general lay-out of a radiophare equipment, a Béthenod alternator A (125 volts, 1 kcy. per second), enables resonance to be established once for all between the primary and secondary circuits of the transformer T (secondary pressure 10 KV.). A board mounted above M A carries the requisite switch-gear and measuring instruments. The whole of the high-tension equipment is mounted in a glazed case with an automatic isolating switch on the door, so that the attendant is exposed to no danger. Four 30-KV. Moscicki condensers are used, and the spark gap E is composed of a brass tube and copper plate; the former is ventilated by a small electric fan V above the transformer. A motor-driven

* It is not, however, to be expected that visual or any other signals at present in use will be abolished, even when the provision of radio-receiving apparatus is compulsory on every vessel. Vast elements of uncertainty must always enter into the problem of securing the safety of ships at sea, and every possible means must be adopted to attain this end. Luminous signals depend on no delicate receiving apparatus, if they can be seen at all; but they may become useless, almost at a moment's notice, owing to the formation of fog. Again, wireless transmitting and receiving apparatus has now attained to a high degree of reliability, but it is difficult to see how a certain considerable risk of derangement can ever be completely avoided in sets designed for use by unskilled men on small vessels. Under such circumstances, the most trivial defect may completely prevent the reception of radiophare signals, just as an "accident" of nature may render ineffective the most powerful lighthouses. Every safety measure must, therefore, be simultaneously adopted.

Blondel automatic transmitter* is employed to make and break the small field current of the Béthenod alternator, and the whole equipment operates automatically without any attention for at least 30 hours.

The International Radio-Convention, held in London last year, determined 150 m. as the maximum wave length, which should be employed by radiophares,† and the Brest aerial has been designed to transmit radiations of from 80 to 150 m. wave length up to distances of 30 nauts. As shown in fig. 1, the guy-cables carrying the

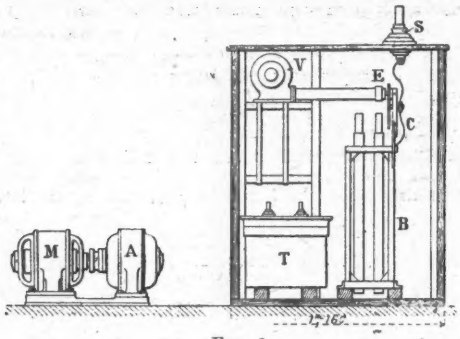


Fig. 2.

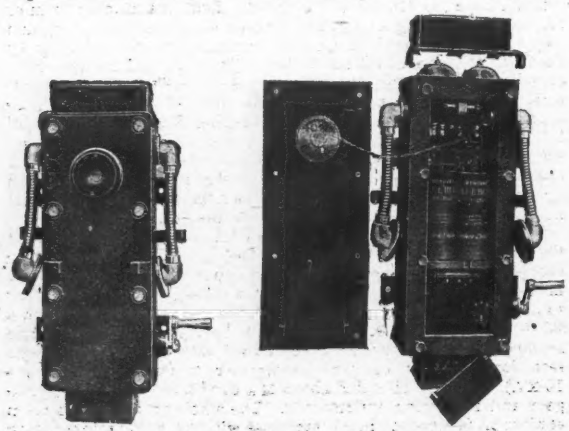
four radiating aerial wires are anchored to the platform of the existing lighthouse; the aerial remains suspended, and working can be continued, even should one of the guy-cables break.

The whole radiophare equipment described costs hardly as much as a wireless equipment for ships, and can be attended and operated by the present lighthouse staff. The equipment needed on ships to enable them to take advantage of this service costs from £14 to £16, and can also be used to receive time signals and weather reports from the Eiffel Tower and other stations which have now established a regular service of this kind.—*Génie Civil.*

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

Mining Telephones.

The Western Electric Co., Ltd., of North Woolwich, have introduced a new pattern of mining telephone to comply with the requirements of the Home Office in gassy mines. The set, which



Figs. 1 and 2.—W.E. Mining Telephone Set, Open and Closed.

is illustrated in figs. 1 and 2, is a local-battery magneto set, enclosed in a heavy cast-iron case, which is neither airtight, gas-tight nor watertight. Special provision is made for the drainage of any condensed moisture, and an explosion-proof flange joint prevents the transmission of flame from the interior to the surrounding atmosphere—this being the chief feature of the set. The transmitter is fixed on the cover, with a steel guard, and the receivers are mounted on rotary arms with short hinged tubes and earpieces. All the apparatus is so arranged that it can be removed from the set while it is in position, and the internal dimensions have been made as small as possible, to reduce the risk of explosion. The magneto generator is permanently bridged across the circuit and the only chance for a spark to occur is when the contact of the switch-hook is broken on the completion of a conversation. The set is fixed to the support by steel plates screwed to the case, so that there is no danger of damaging the castings when driving or drawing spikes. Every precaution is taken to render the apparatus reliable and foolproof, and to provide for the replacement of parts by an unskilled attendant.

* Two contact makers are connected in series. In the present case, one contact is closed by a cam for 10 secs. at intervals of 30 secs., and the second contact is opened and closed continuously, and repeatedly transmits the code call of the station during the period in which the first contact is closed. By varying the control cams, an indefinite number of code-signals can be arranged, and there is nothing (beyond general undesirability), to prevent three contacts being used in series to provide more complex signals.

† In order that the continuous working of these stations should not interfere with other wireless work. At Ouessant, a radiophare is only 1½ miles from a public service station, the operation of which is, however, in no wise affected by the 125 m. waves used by the radiophare.

New Fuse Box.

The Metallic Seamless Tube Co., Ltd., Wigan Street, Birmingham, are marketing a new pattern fuse box, which is supplied single and double-pole, and tapped to receive ⅜-in. or ½-in. conduit. The boxes are fitted with either single or double

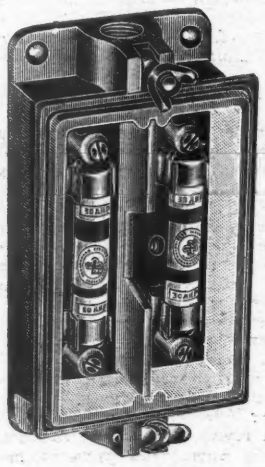


Fig. 3.—New Pattern Fuse Box.

pole fuses, which are mounted on a small slate base with a dividing fillet in the case of the double-pole box, and fitted with pillar-type terminals for front wiring, with a capacity of 5 to 30 amperes.

BUSINESS NOTES.

Consular Notes.—Argentina.—The British Consul at Buenos Ayres reports that the output of the German trans-Atlantic Electrical Co. during 1911 was as follows:—Light, 46,909,800 KW.-hours; power, 18,200,500 KW.-hours; traction, 63,718,800 KW.-hours; total, 128,829,100 KW.-hours. The returns of the same company for 1910 show a total of 97,927,900 KW.-hours. A syndicate of British, French, Belgian and American bankers is reported in the newspaper Press to have formulated a scheme for the building of an electric power station at Buenos Ayres for the supply of electricity for motive power and lighting purposes at prices considerably below those at present prevailing. A concession was applied for, which would bring the German monopoly of the supply of electricity to an end. The proposed contract stipulated that the plant should become the property of the Government at the end of 1957. Italian financiers are also said to be endeavouring to obtain a similar concession, the new company to be known as the Italo-Argentine Compania de Electricidad. The German company having their mains extended to every part of the capital, are naturally firmly established in this city.

The British Vice-Consul at La Plata reports that the British Electric Light and Power Co. inaugurated their new station on March 10th, 1912, and it was understood to be their intention to double the capacity of the station. The La Plata Electric Tramways Co., Ltd., are now laying rails from La Plata to the Port, thus giving an electric tramway connection, in addition to the railway service. There are several new concessions applied for by the existing tramway companies for the extension of their lines, the principal one being that asked for by the La Plata Electric Tramways Co., Ltd., for the outskirts of the city, and to connect up with the new station of the provincial narrow-gauge railway. The telephone wires in the town are now being put underground, and the area lighted by gas or electricity is being extended.

The British Consul at Buenos Ayres, reporting on the tramways of that city, states that although the streets in the centre of the town are only 10 yards wide, the excellent service of the Anglo-Argentine Tramway Co. plies in almost every street. The cars

are worked on single tracks laid along the side of the street within 15 in. of the narrow foot pavement, and receive their power from overhead cables. The car routes intersect one another at the end of every block of buildings, that is, at intervals of about 450 yards, and are undoubtedly a great source of danger to pedestrians. Blocking of the traffic in the centre of the town is of frequent occurrence, notwithstanding that the cars, as well as all other vehicles, are allowed to run in one direction only in each street, *i.e.*, up one street and down another. With the increase in the population the congestion of the street traffic is becoming a difficult problem to deal with, and it will sooner or later have to be the met by the adoption of either underground electric railways, or by a system of overhead tramways. A scheme has, in fact, been put forward by the Argentine Tramway Co., for the construction in the congested area of underground lines to work in conjunction with the present lines. The total length of tramway track is about 450 miles. The traffic receipts of the various tramway companies in Buenos Ayres during the first seven months of 1912 amounted to £1,886,100, representing the fares of 217,292,200 passengers. In 1910 and 1911 the traffic was as follows:—

	Passengers.	£
1910	323,782,700	2,658,600
1911	355,682,900	2,930,000

Honduras.—The British Consul in Honduras reports that at present all contracts for public works, all concessions for railways, &c., are given to United States contractors. The Government does not make public such contracts, and, indeed, does not even initiate them, but generally waits until some enterprising contractor makes suggestions and submits prices. There is no reason why British firms should not receive a part of the business. They should make themselves known to the Honduranean Government, and appoint an agent in the capital to keep them informed of any likely business. This the Consul cannot do for obvious reasons, and principally because these negotiations are usually kept quiet until the contracts are signed.

The ports on the north coast have sprung so rapidly into being with the construction of railways that no doubt their importance has not yet been realised by British merchants. They would be well advised to send out representatives to examine the trade possibilities, which, although at present comparatively small, are likely to grow rapidly and to be of great importance before British merchants are able to get into the market. Our United States competitors are not only supplying articles which British manufacturers could supply if they took an interest in the market, but they are gradually learning to manufacture goods after the British style, although not so good in quality or so advantageous in price. Nevertheless the orders being small and the delivery from the United States more rapid, together with the total absence of British commercial travellers to show their goods and arrange terms of credit, the merchants very naturally take little interest in British trade. There is no doubt that British firms could, if they made an effort, regain a large part of the trade that has been lost. This is the opinion of a great number of merchants. But an effort must be made. It is not sufficient just to send out catalogues in English. They must be printed in Spanish, otherwise they are of little value; and at the best catalogues, unless followed up by commercial travellers, are little more than an unattractive bait to merchants who have long been used to the misrepresentations in foreign catalogues. Terms of credit, too, must be made attractive and such as to suit the exigencies of the local money market, which is entirely dominated by the banana crop. For example, when drought sets in or heavy winds blow down the crops, money is scarce and merchants are unable to meet their obligations punctually. United States travellers watch and understand perfectly the embarrassments of their clients, and consequently arrange to meet them half-way. There is no apparent reason why British manufacturers should not imitate their competitors and seek to manufacture that which suits the market at attractive prices, even if the particular article must be inferior in quality. The trade of Germany with the Atlantic coast of Honduras is small at present, but is likely to expand now in view of the new steamship service opened up by the Hamburg-American Line between Hamburg and Puerto Cortez. In June last an experiment was made by the company to carry bananas from Cortez to Hamburg. The venture was, it is said, a great success, and since then two other voyages have been made. It will, therefore, readily be seen what an advantage this will be to German trade, and British firms would do well to follow the example of their competitors.

Catalogues and Lists.—Messrs. Gent & Co., Ltd., Faraday Works, Leicester.—Catalogue No. 12 (44 pages) containing illustrations, brief particulars and prices, of a variety of electric bells and telephone instruments for domestic, office, mining and other service; also indicators, batteries, cables and wires, and accessories. A hanging wall show-card is to hand illustrating their "Electromatic" telephones (automatic C.B. interphones). Further, we have received a copy of a testimonial from the rector and churchwardens of Ruardean Parish Church concerning the satisfactory service that is being rendered by a Gent electric clock installed three years ago in the church tower.

Messrs. Neville & Co., Midland Electrical Works, Bracebridge Street, Birmingham.—40-page art paper catalogue, giving illustrations with prices of a representative selection of electric light fittings—brackets, ceiling fittings, pendants, electroliers, hall pendants, lanterns, floor and newel standards, luminous and Bastian type radiators and advertising signs.

India-Rubber, Gutta-Percha and Telegraph Works, Co., Ltd., Silvertown, E.—64-page well-arranged and fully-illustrated catalogue of "Silvertown instruments," including Morse and Wheatstone apparatus, sounders, portable testing sets, vibrators, lightning protectors, reflecting and needle galvanometers, portable batteries for testing sets, resistance boxes, the Appleyard conductometer, testing keys, condensers, switches and commutators, patent terminals, water-level apparatus, and numerous other manufactures of the same character.

Messrs. Simplex Conduits, Ltd., Garrison Lane, Birmingham.—Eight-page list (No. 477, catalogue section "W") giving tabulated particulars and prices of wires and cables, including the usual grades of vulcanised cables for electric lighting, flexible cords, and bell wires.

The Sun Electrical Co., Ltd., 118-120, Charing Cross Road, London, W.C.—Thirty-six page catalogue (Section "S"), in which they give full information, with numerous illustrations, also photometric tests, and prices, concerning their "Sunlite" and "Sunline" reflectors. The contents in the main include wireless china, lipeal, curved picture lighting, box, and other reflectors, window reflector signs, window fitting lighting accessories, indirect lighting fittings, outside lanterns, and metal and carbon lamps for same. The picture lighting reflector described, concentrates the light upon the middle portion of the picture where it is most desired. It is fixed at the top close to the picture, and can be decorated to harmonise with the frame or surrounding decoration.

British Arc Welding Co., Ltd., Suffolk House, Laurence Pountney Hill, E.C.—Pamphlet describing the system employed (using an iron welding pencil instead of a carbon rod, so as to avoid a hard weld) in repairing ships' boilers, furnaces, frames, gears, &c., in position, with the aid of portable generating plant. Numerous illustrated examples of work done are given.

The British Thomson-Houston Co., Ltd., Mazda House, London, E.C.—New edition of their folder "The Necessity for Scientific Reflectors" (S. 2,317), dealing briefly and popularly with the functions and advantages of a scientific reflector. The contents include description and prices of Veluria, Holophane and Mazdalux reflectors, also galleries and Mazda lamps. Folder No. S2,319 describes and prices the various types of "Veluria" reflectors. These have not long been on the market, but they are already widely used.

Messrs. Siemens Bros. Dynamo Works, Ltd., Tyssen Street, Dalston, N.E.—Price list No. D7 (12 pages) giving illustrations, prices and other particulars of close upon 20 different designs of their rise and fall pendants for dressing rooms, &c.

Trade Announcements.—Mr. G. Ellam (who for some years has acted as branch manager of the supply department of the British Westinghouse Electric Co. for the London district) has been appointed assistant manager of the supply department at the company's headquarters at Long Millgate, Manchester. Mr. F. Rook (late of Messrs. Baxter & Caunter, London) has been appointed to succeed Mr. Ellam as London branch manager of the supply department at 179, Wardour Street, W.

Messrs. G. Harland Bowden & Co., announce that for greater convenience in their business, they are moving their offices from the City to Westminster. Their address is now 1, Victoria Street, Westminster, S.W.; telegraphic address, "Harbowdeco, Vic., London"; telephone number, "Regent 1009."

Book Notices.—*The Chemical Trade Directory*, 1913.—London; The *Chemical Trade Journal*.—This is the fifth edition of a very serviceable work, in which there are arranged both alphabetically and in classified sections, the names of chemical manufacturers, merchants, brokers and agents, and makers of chemical plant in Great Britain and Ireland. The closing section of the book (some 20 pages) contains a copy of the Alkali, &c., Works Regulation Act of 1906, an abstract of the Alkali Report for 1911, a statement from the Census of Production relating to the chemical trades, price diagrams of metals, chemicals, acids, &c., also tabular statistics regarding three years' exports and imports of chemicals and allied products.

"Science Abstracts." Vol. XVI, Part 2. February 25th, 1913. Sections A and B. London: E. & F. N. Spon, Ltd. Price 1s. 6d. net each.

"*Transactions* of the N.-E. Coast Institution of Engineers and Shipbuilders." Vol. XXIX, Part 4. March, 1913. Newcastle-on-Tyne: The Institution. Price 5s.

"*Transactions* of the Institution of Engineers and Shipbuilders in Scotland." Part 5. 1912-13. Glasgow: The Institution.

"*Journal* of the American Society of Mechanical Engineers." Vol. XXXV, No. 3. March, 1913. New York: The Society. Price 35 cents.

Patent Application.—Application has been made by Harvey Hubbell for the restoration of patent No. 15,801 of 1901 for "Improvements in Holders for Electric Incandescent Lamps," which expired on August 6th, owing to non-payment of renewal fee.

Dissolutions.—Dewhurst, Taylor & Co., mechanical and electrical engineers, Soho Works, South Street, Heywood.—Messrs. A. S. Dewhurst and J. Taylor have dissolved partnership. Mr. Taylor will attend to debts, &c.

Flamwell & Shotton, mechanical and electrical engineers, Church Walk Works, Worksop.—Messrs. T. H. Flamwell and E. W. Shotton have dissolved partnership. Debts, &c., are being attended to by Mr. Shotton, who, since January 1st, has carried on the business under his own name at the same address, and will continue to do so.

Bankruptcy Notices.—Samuel Smith (Smith & Sons), Victoria Square, Widnes, "*Music and Musical Instrument Dealer*) *Electrical Engineer and General Dealer.*"—Receiving order made March 10th at Liverpool, on debtor's petition.

Mitchell, J. & F. (Fred. Mitchell & Co.), electrical engineers, Ardwick, Manchester.—First meeting, March 27th; public examination, April 25th, both at Manchester.

William Longdon and Vernon George Cobb (trading as Longdon & Cobb), electrical engineers, 101A, Derby Road, Nottingham.—The adjourned public examination of the above-named debtors was held at the County Court House, St. Peter's Gate, Nottingham, last week. In answer to the Official Receiver, the debtor, Longdon, said that it was in August of last year that he first found that the firm was financially involved, and the trading losses during the 10 months totalled £250. Asked why he had continued to pay a money-lender 10s. a week after he had met his creditors, debtor said that some of his creditors had expressed the desire that he should go on, and if he had not paid, the money-lender would have taken all his assets. The Official Receiver said he thought that the examination of Longdon should be adjourned. This the Registrar ordered, while the examination of Cobb was declared closed.

James William Lewsley, electrician, 65, Brierley Street, late 103, Mansfield Road, Nottingham.—The public examination of the above-named debtor was held at the County Court House, St. Peter's Gate, Nottingham, last week, when the case was ordered to stand adjourned in order that an amended statement of affairs might be furnished.

For Sale.—The Ayr Corporation has for disposal a number of open-type A.C. arc lamps and accessories. Messrs. Fuller, Horsey, Sons & Cassell will, on March 27th, sell by auction the electrical rolling stock used on the "All Red-Route Railway" at the Crystal Palace. See our advertisement pages in this issue.

Battery Manufacture in France.—La Société de l'Accumulateur Robust is the name of a new concern which has just been formed at Glos-sur-Lisieux (Calvados), with a capital of £16,000, to manufacture a new accumulator.

LIGHTING and POWER NOTES.

Acton.—The Metropolitan Electric Supply Co. has sent in a tender of £25 for the lighting of the Acton Cottage Hospital by electricity, which very many members of the governing body are in favour of, regarding it as a great improvement on the present methods.

Altrincham.—The U.D.C. has received from the Altrincham Electric Supply Co. a portion of the scheme for the suggested lighting by electricity of Railway Street, Stamford New Road, and George Street. This consists of 41 lamps of 100 C.P. each, extending from the foot of the Downs to the junction of Barrington Road and Stamford New Road, the cost of the installation being given as £383. The matter is to be further considered at a meeting of the Highways and Lighting Committee.

Arbroath.—A proposal to work the dockgates by electric power has been under the consideration of the Harbour Trustees, and recently a deputation inspected the electric motor gear at Kirkcaldy Harbour. On the ground that it would take "thousands of pounds to equip the Arbroath dockgates similarly to those at Kirkcaldy," the proposal has been dropped.

Argentina.—The Compagnia Italo-Argentina di Elettricità is the title of one of the two companies which have obtained concessions in Buenos Ayres in competition with the German Transmarine Electricity Co., the other being the Lacroze Co., as previously mentioned in this journal. Originally formed as far back as October, 1911, the Italian company received the grant of its concession in August, 1912, and the plans of the power-station and distributing network are to be completed by the end of April, so that two or three years will have elapsed before the works are completed. The share capital is £440,000, and the undertaking will, therefore, be a comparatively modest enterprise which is said to reckon chiefly upon the custom of the Italian colony in Buenos Ayres. Most of the capital has been subscribed by Italians, the remainder having been furnished by Argentine subjects. Among the former are the firms of Pirelli & Co., of Milan, Franco Tosi, of Legnano, and the Tecnomasio Brown-Boveri, of Milan, who are said to have been induced to participate because Italian firms have no longer been given orders, as in former years, by the German Transmarine Electricity Co. These firms, which respectively make cables, engines, and generating plant, have assured themselves, by co-operation in the provision of the capital, of contracts of the value of £400,000.

Ashton-under-Lyne.—A startling discovery was recently made at the Corporation refuse destructor, which adjoins the electricity works. An employé, in delivering refuse to the destructor, discovered among the rubbish a 12-pr. lyddite shell, which, on examination, proved to be a live one. Had the shell reached the destructor furnace, there is little doubt that the plant would have been wrecked.

During the past month, 29 street lamps have been converted from gas to electric light.

Barnsley.—The Electricity and Lighting Committee has had under consideration a report by the borough electrical engineer, on the condition of the old mechanical stokers at the electricity works, and has decided that four of the original mechanical strokers be replaced by four Bennis sprinkler stokers, at a cost of £525, to be defrayed from the reserve fund.

Bradford.—The city architect has been instructed to arrange for the construction of an electricity sub-station at Odsal at the same scheduled rates as those for Thornbury sub-station.

Bridlington.—Owing to delay on the part of the L.G.B. in holding an inquiry into the Corporation's application for sanction to borrow £4,100 for the installation of a steam generating set at the electricity works, it has been necessary to hold a special meeting of the T.C. to consider the matter. Alderman Collins said the development of the town and the demand for current made it absolutely essential that they should have new plant, and though he did not anticipate that the L.G.B. would place any impediment in the way of the extension, if the Corporation were to cope with the summer demand for current, the work would have to be proceeded with at once. The Council unanimously decided to authorise the Committee to accept a tender of £2,867 for the plant required, and to accept the tenders for the installation.

Bristol.—At the last meeting of the City Council, Ald. Lloyd, speaking on the report of the Finance Committee, called the attention of the Council to the fact that in the matter of street lighting it was proposed, with the help of the Electrical Committee, to reduce the cost of electric lighting in the streets by £1,000 in the coming half-year, and stated that, no doubt, there would be a similar reduction in the following half.

At a meeting of the Sanitary Committee held later in the week, it was reported that a letter had been received from the City electrical engineer (Mr. H. Faraday Proctor) setting forth suggested alterations, which amounted to a reduction of the cost of the arc lamps by £2,000 per annum; and the conversion of some 700 gas lamps to electric lamps, to which the current would be supplied free of cost.

Continental Notes.—Spain.—A comprehensive scheme of water-power utilisation is now being carried out under perpetual concessions by the Compagnie Barcelonaise de Traction, d'Elairage et de Force. The water-powers are located on the Rio Noguera Pallaresa, the Rio Segre and the Ebre, and are capable of furnishing 300,000 H.P., of which 137,000 H.P. is to be first brought into use by two large and two auxiliary stations. The Seros station, on the Rio Segre, will comprise four generators of a total of 56,000 H.P. and is expected to be set in operation at the end of the present year. In the case of the Los Tarradets station on the Noguera Pallaresa, there will be five generators with a total output of 70,000 H.P., and the work is to be completed in October, 1914. The two auxiliary stations are situated at Talarn and at Pola respectively, and will yield 11,000 H.P., the latter being now finished. The stations of Seros and Los Tarradets, which are both 86 miles distant from Barcelona, will be connected with the latter by means of two transmission lines carried on steel standards, the current being transmitted at 110,000 volts to sub-stations in the suburbs of Barcelona. These lines are already in course of erection, and with their branches will have a total length of 228 miles, whilst the length of the secondary distributing network will be 210 miles at 25,000 volts, and 85 miles at 6,000 volts. It is definitely believed that the company will be able to meet all the power requirements in Barcelona and district, apart from the working of the tramways, which are already in the company's possession. During the past 12 months the company has secured contracts to supply 80,000 H.P., and it is expected that these will have risen to 100,000 H.P. when the first stations are brought into operation this year.

It is stated that an end has now been put to the ruinous competition which has existed for a long time past between the electric supply companies in Madrid, and which has only been of advantage to the consuming public in consequence of the very low prices charged for supply. It has now been agreed that the companies shall form two groups—the Electra and Giamberi on the one hand, and the Union Electrica on the other—and the receipts are to be pooled and divided in equal shares. A joint committee of inspection consisting of eight members has been constituted, and the chairman of each group will occupy the presidency of the committee in alternate years. The tariff, which had fallen to 1·92d. per KW.-hour under the effects of the competition, has been raised to 5·76d. The agreement is for a term of 60 years, and it is expected to be extended shortly so as to include the Hidro-Electrica Espanola and the Hidraulica Santillana.

France.—A new company has lately been formed in Paris (159 Boulevard Pereire) with a capital of £20,000 and the title La Société Electrique de Saint Friest et Extensions.

Russia.—It is reported that the Moscow Electric Co. has acquired a large deposit of peat in the Bogorodsker district, and proposes to establish a large generating station near the same, with the object of transmitting the current generated to the city of Moscow.

Crumpsall.—At a meeting of the Manchester B. of G. recently, the clerk reported that the L.G.B. had sanctioned an installation of the electric light at Crumpsall Workhouse at a cost of £4,755, and also the borrowing of £4,300 for carrying out the work, which has been let to a firm of Salford electrical engineers.

Darlington.—Unlike some municipal electricity undertakings, that at Darlington has always been able to show satisfactory results. Up to the end of 1911 the total capital expenditure on generating plant, mains, &c., was about £82,000. The total capacity of the plant, including the batteries and allowing one set for traction and one set as spare, is about 1,900 KW., and the maximum load during the present winter has exceeded 1,800 KW., which is 50 per cent. higher than the maximum load of the previous year. For the nine months ended December 31st last, the output was 60 per cent. higher than that of the previous corresponding period, and for the year ending March 31st next it is anticipated by the Darlington Corporation's electrical engineer, Mr. J. R. P. Lunn, that the output will amount to over four million units. The bulk of this increased output has been taken by power consumers, but there has also been a large increase in the private lighting units. It is estimated that for the current year the cost per unit, excluding only interest and depreciation, will be less than ½d., in spite of the increased cost of coal. This will be the lowest on record for any undertaking with an output of less than ten million units per annum, and there are only five larger undertakings with costs lower than ½d. per unit. There are now 392 motors, representing 4,354 H.P., connected to the Darlington mains, and 14 of the large works in the town are being supplied with electricity for power purposes from the municipal station. Recently a supply has been given to the works of the Cleveland Bridge and Engineering Co., and in this connection and also owing to the fact that it is anticipated that, during the next 12 months, the output will increase by about 300 KW., it has been decided to install a 1,000-KW. turbo-generator, with rotary converters and condensing plant, and the cost of these, together with the necessary pipework, foundations and switchgear, is estimated at £7,770. In order to cope with the increased output, it has been decided also to provide a new boiler, which, including fittings, superheater, mechanical stoker, pipework, foundations and setting, will cost about £1,460. There will also be provided an additional feed pump to the two boilers, which will supply the new turbo-generator, and the cost is estimated to be £130, and of two superheaters, including the pipework, £230. An additional coal storage, of 1,000 tons capacity, will be provided, at an expenditure of £470. Accordingly, contracts have just recently been entered into with Messrs. Richardsons, Westgarth for one 1,000-KW. turbo-alternator; with the British Westinghouse Co. for one 750-KW. and one 250-KW. rotary converters; and with Messrs. Babcock & Wilcox, for one water-tube boiler. Application is being made to the L.G.B. for a loan of the afore-mentioned amounts, as also for £530, the cost of a new fuel economiser, recently installed; and for £8,000 for prospective expenditure on mains and services; and for £1,500 for static transformers for supplying alternating current at high pressure and thus reducing the cost of the large power mains.

The Council has decided to fit penny-in-the-slot meters in houses where required, the charge being at the rate of 4½d. per unit, including the supply of metal-filament lamps to consumers.

Edinburgh.—The Electric Lighting Committee has considered a communication from the Colinton Tramway Co. asking on what terms the T.C. would give it a supply of energy for resupply to Redford Barracks. The company's order entitles it to get a supply of electricity at the boundary for the tramway at the same price as charged ordinary consumers. It was understood from the application for a supply that the company desires afterwards to sell it at its own price. To that attitude objections were expressed by members of the Committee, and the town clerk is to write to the company and the military authorities pointing out the objections. It is stated that the view is that the Corporation should, if possible, supply the lighting direct to the barracks.

Farnworth (near Bolton).—The Electricity Committee has decided that the price of electricity for lighting purposes be reduced, from April 1st next, to 4½d. per unit, subject to a discount of ½d. per unit if accounts are paid within 21 days. It was also resolved that power consumers of 2,000 units and over per quarter be allowed 10 per cent. of the same for lighting and other purposes, current for lighting in excess of this quantity to be charged for at lighting rates.

Hereford.—An inquiry has been held by the L.G.B. relative to the application of the Corporation for sanction to borrow £1,600 for the installation of electric pumping machinery at the waterworks. It was stated that the adoption of the scheme would have the effect of converting the electricity undertaking into a profitable concern, owing to the increased supply of current when the load was lightest. Some opposition was raised, an expert being called, but the Corporation officials declared he was taking a fictitious basis of calculations, and one which was out of date. A petition containing 317 names was put in against the scheme, but several of the chief objectors merely desired the scheme postponing in order that the merits of another make of pump should be considered. The Inspector, however, refused to admit discussion of this pump. It is proposed to use the existing plant as a stand-by, and it was urged by the promoters that if the £1,000 on the cable were not sanctioned, an expenditure of £800 would have to be made to meet the increased demand for current and light.

Holmfirth (Yorks.).—The Electricity Committee, last week, reported to the District Council that the Yorkshire Electric Power Co. had declined to supply electricity in bulk, and has recommended that an engineer be instructed to prepare a scheme for the generation of electricity for the town. The Council already has powers of distribution, and has decided to invite competitive schemes from engineering firms.

Kirkcaldy.—The Harbour Committee of the T.C. is considering the substitution of electric light for the gas lighting at the harbour. From figures submitted it appears that for three recent months gas cost £69, while mantles for the same period cost £35. In view of this, the borough electrical engineer is to submit estimates for electric lighting.

Lowestoft.—The T.C. has decided that from the current March quarter the charge for energy for power shall be 2d. per unit up to a consumption of 2,000 units per quarter, and 1½d. beyond. The charge for private lighting is to be increased to 5d. per unit, with 5 per cent. for prompt payment of accounts, and the charge for incandescent outside shop lighting is to be increased to 2s. per quarter per fitting.

Lytham.—The interesting contest for the right to supply electricity to Lytham between the Lytham D.C. and St. Anne's D.C. reached its final stage on March 13th, when a B. of T. inquiry into the applications was held. Years ago Lytham Council possessed powers to supply electricity, but transferred them to a private company, which did not proceed with the scheme. Within the last two years another effort was made by a local company to supply electricity, but owing to the poor public response the company dropped the scheme. Following this came an application to St. Anne's Council from residents in Ansdell to supply them with electric light. In view of this move both Councils almost simultaneously applied for the necessary powers.

Mr. W. Fielden, of Lytham, presented a petition, signed by 270 ratepayers, against the Lytham application.

Mr. Browne, in presenting Lytham's application, said anyone who had gone over the district would be convinced the area afforded an exceptional field for the supply of electricity. He read a letter from St. Anne's Council offering to supply electricity within the Lytham district at 4½d. per unit for 75,000 units, 4d. per unit for 100,000 units, and at the same proportionate rate down to the minimum of 3d. per unit. In addition, he proceeded, Lytham was to pay the cost of the order. Lytham Council thought the prices were too high, and in January, 1905, entered into an agreement with Messrs. Foote & Milne to carry out the supply of electricity within Lytham. Messrs. Foote & Milne got the necessary order, but they did not proceed, and the order lapsed. The order was revoked in April, 1912, and immediately afterwards the Council took the matter into its own hands. The Board, he claimed, should give preference to Lytham. He did not think the tramway company was in a position to put up a generating station for its own supply. The site of the proposed generating station was near the railway station, and the Council was bound by contract never to put up a chimney and not to use steam upon the site. The proposal was to use Diesel plant.

Mr. J. H. Tonge, engaged to prepare Lytham's scheme, said the first year he estimated the receipts at £2,500 and expenses at £3,000; in the second year, receipts £3,500 and expenses £3,400; and in the third year, receipts £4,300 and expenses £3,800. The profit in subsequent years would continue to increase.

The inquiry was continued on Friday. Mr. Browne called Mr. Robert Hammond to give evidence in support of Lytham's application.

Mr. J. Ainscough, chairman of the Lytham Council, said it would be most objectionable that the powers asked for by St. Anne's should be granted. He believed if the works were erected at Lytham they would get many customers.

After additional evidence on similar lines, the Lytham case was closed.

Mr. Askworth, for the tramway company, said it had been advised not to take current from Lytham under any circumstances. It had power to supply its own current, and would erect a station. If the order was granted to Lytham, the latter would never supply the company. St. Anne's came to the aid of the company with electricity when Lytham was unable to supply, and the company was compelled to go to the expense of putting mains down in Lytham.

The St. Anne's case was presented by Mr. Hutchinson.

Newport (Mon.).—In view of the extremely heavy capital charges of the undertaking, and of the proposals for extending the plant, the erection of offices and stores at the east power station has been postponed, and the application to the L.G.B. for sanction to borrow the estimated cost of such buildings withdrawn.

The lighting of Commercial Street is to be improved, and, as an experiment, central suspension lamps are to be used. A total of 56 lamps in various parts of the borough are to be converted from gas to electricity. The question of extending the plant at the electricity works, at an approximate cost of £12,974, is under consideration.

North Yorkshire Water Power Schemes. — *The Morning Post*, in a recent article, points out that many of the small villages in the North Riding are going straight from the use of candles and oil to electricity. This is due to the abundance of streams in the Yorkshire Dales, and an inquiry addressed to secretaries and others connected with these undertakings has elicited some interesting facts. A number of schemes are still in embryo, but of those in actual operation special mention is made of the installations at Grassington, Hawes, Askrigg, Kettlewell, and West Burton. All have been organised locally, and the proprietors are, in most cases, if not all, inhabitants of the places supplied. Reference is made to the scheme being adopted at Kettlewell, where, at a cost of £560, it is proposed to provide a supply for 77 buildings, and about 400 lamps.

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Rishton.—The Council has considered a letter from the Accrington Corporation in regard to the supply of electricity to the Rishton Paper Works, and has decided that it cannot consent to the Corporation's supplying electricity within the Rishton district.

Romford.—The U.D.C. has declined an offer made by Mr. W. T. Pressland, to transfer, when obtained, his Electricity Provisional Order, on payment of a consideration, provided that the Council would consent to the order being granted.

With reference to the application of the County of London Electric Supply Co. for a prov. order for electric lighting in the rural area, the R.D.C. has practically arranged terms, except on the question of maximum price and damage for severance on purchase. The company has expressed willingness to forgo damage on severance provided the Council is willing to take a supply in bulk for a period of 15 years, if it desired to purchase the undertaking after the expiration of the statutory period.

Ruthin.—The T.C. has appointed a Committee to go into the question of an electric lighting installation for the town.

St. Anne's-on-Sea.—At the March meeting of the U.D.C. the electrical engineer reported that for the year there was an increased sale of 58,000 units, and that the number of consumers was now 1,251, against 1,104.

Sidmouth.—The sum awarded in the arbitration for the purchase by the Council of the Sidmouth gas and electricity undertaking is £34,684; an additional £8,500 represents costs and other expenses incurred in the proceedings.

Southampton.—Arrangements have been made for the supply of energy to the proposed factory on the Western Shore, subject to the lessees taking all energy from the Corporation for 15 years, with a minimum consumption for the second year of 500,000 units, for the third year 600,000 units, and for the residue of the term 750,000 units per annum, at ·625d. per unit from midnight to half an hour after sunset, and 1·5d. from half an hour after sunset to midnight.

Stockton-on-Tees.—The T.C. is considering a scheme, suggested by the electrical engineer (Mr. J. J. Smith), of municipal maintenance of consumers' lamps.

Sunderland.—At a meeting of the T.C. on the 12th inst. Alderman Bruce moved the adoption of the report of the Electricity and Lighting Committee. This recommended that the minute passed by the Council, adopting a scheme for paying off the balance of the outstanding loans on the disused steam-generating plant be rescinded; that the L.G.B. be informed that the Council, in accordance with the request in the Board's letter, has reconsidered the scheme for extinguishing the debt on the superseded plant, and has decided to sell such plant, and to undertake to pay off the outstanding debt thereon within a period of five years from April 1st, 1913, and, further, that the proceeds of the sale together with interest thereon be paid to a separate "Superseded Plant Account" until such time as the balance of the outstanding loans have been met, and that meanwhile the profits of the electricity undertaking be carried to a reserve and renewals fund. Mr. Bruce said, if they accepted the tenders they had received, and supplemented the amount received by an annual sum of £520 from the yearly profits, it would wipe out the whole of the outstanding debt in five years. Mr. R. J. Wilson, seconded the report. Mr. Lawson said it was an unpleasant surprise to hear that the electricity undertaking now recognised the advantage of a reserve and renewals fund. They had always been given to understand that this was met by the sinking fund. The report was adopted.

In connection with the sale of the plant, it is stated that offers have been received from eight firms for amounts totalling £7,250.

Swinton.—The Tramways and Electricity Committee have decided to offer current to the Highway and Street Lighting Committee for street lighting at 1¼d. per unit, for all-night burning, provided that each lamp is of not less than 80 watts capacity. This offer has been accepted. Subject to certain conditions the Committee resolved that current be offered to shopkeepers and others for outside lighting on the following terms:—For consumers using current at the alternative rate, 1s. per quarter for 63-watt lamp, and 1½d. per unit; for consumers using current at the flat rate, 2½d. per unit plus meter rent.

Experiments are to be tried at various points with electric street lighting, preparatory to a considerable extension of the system along the local tram routes.

The L.G.B. has sanctioned the borrowing of £600, repayable in 15 years, for the supply of electricity in Broad Oak Park. The Electricity Committee has been empowered to accept suitable tenders for the extension and for the supply of materials.

Taunton.—The Council has decided, on the recommendation of the E.L. Co., to apply to the L.G.B. for sanction for a loan of £2,500 for new plant at the electricity works.

Truro.—At the B. of T. inquiry held respecting the application by the T.C. and the Gas Co. for prov. orders for electric lighting, it was stated that the Gas Co.'s scheme was estimated to cost £7,535, and the estimated profit after four years was £494. Mr. A. E. Brooks, manager of the Ascot Electricity Co., expressed the opinion that it was extremely doubtful whether anyone, apart from the Gas Co., could make electricity pay in Truro.

Troon (Ayrshire).—The T.C. has instructed the clerk to ascertain the probable cost of obtaining an Electric Lighting Order, with power to transfer the same to a company.

Tynemouth.—It has been decided to reduce the lighting tariff as follows:—Flat rate from 4½d. to 4d. per unit; demand system from 5d. and 2d. to 5d. and 1½d.; arc lamp rate from 3¾d. for a 6-ampere arc to 3½d. per hour. The engineer estimates that this scheme will entail a reduction in profits of approximately £660, but, if not put in force until the second quarter of the ensuing financial year, this sum would be reduced to £600. It is estimated that the profit of the present year's working will amount to about £1,250, which will go towards the paying off of the deficit (£1,600) still remaining on the undertaking. The Tynemouth Traction Co. have decided to postpone taking action in the matter of severing the electrical connection between the Tyneside Co.'s rails and their own rails until the matter has been discussed between the Corporation and the company. The carrying out of this scheme will, it is stated, entail considerable readjustment of matters on the part of the electricity department of the Corporation.

Uruguay.—The directors of the State Electric Light Stations have presented their report to the Finance Minister on the working of the various stations during 1912. The increase of subscribers was 4,050, of incandescent lamps installed 69,818, and 1,411 new motors, equivalent to 8,113 H.P. The output for the stations in 1910-11 was 12,266 440 KW.-hours, and in 1911-12 16,281,410, and from July 1st to December 31st, 1912, 11,209,771 KW.-hours. The net profits for 1910-11 amounted to $556,566.26, and for 1911-12 to $725,350 60. A considerable decrease was made in the tariff during the past year for power purposes. Amongst the new works carried out in 1912 were 151,778 m. of subterranean cable for both high and low tension, 145,870 m. of aerial lines and 13 new substations.—*Review of the River Plate.*

Wakefield.—The City Council has entered into an agreement with the West Riding C.C. for the supply of electricity to the County Hall and the extensions thereto.

Whitehaven.—The T.C. has decided that in future in the case of wiring of consumers' premises for connecting heating and cooking apparatus to the mains, the length to be supplied free should be limited to 25 ft., and that the consumer pay cost price for the excess, provided that on the termination of the agreement the excess payment be returned, less 10 per cent. for each year's use.

Whitworth.—The U.D.C. has received from the B. of T. an intimation that the question of revoking the E.L. order, 1905, is deferred until April 17th next. The Council has appointed Mr. H. Wilkinson, electrical engineer to the Radcliffe U.D.C., as consulting electrical engineer in connection with a scheme for which a loan of £5,000 is being sought.

Worcester.—At a recent meeting of the Council, the Electricity Committee recommended the Council to enter into a contract with the British Insulated and Helsby Cables, Ltd., to purchase from it all cable the Council required for three years. The contract came before the Council for the second time. Several members had previously said that the Council would prejudice their interests by accepting the contract. Mr. W. Sharpe contended that the bargain was a bad one. He believed a ring had been formed among the makers of cable, and the Corporation should try to buy outside it. Members who had hitherto voted against the contract, now said they were satisfied that it was an advantageous one. The Committee's recommendation was adopted.

TRAMWAY and RAILWAY NOTES.

Bradford.—The general manager of the City tramways (Mr. C. J. Spencer) has reported upon the working of the revised system of fares from the time of the change on May 1st last year to December 31st. The revision fixed fares on cars boarded before 9 o'clock in the morning at ½d. for every 1d. stage, instead of the previous arrangement of 1d. for any distance. This, of course, reduced the fares for short-distance passengers, but increased those of some of the longer distances. The report shows that, dealing with the hours before 9 a.m., the car-mileage has increased upon that of the corresponding period of the previous year by 92,738, the receipts have decreased £2.394 (2·09d. per car-mile), and the passengers have increased 2,439,095, or 2·44d. per car-mile, an increase of 49 per cent. Notwithstanding this the receipts, it is seen, have decreased 11 per cent. At 7·428d. per car-mile the operating cost of the additional 92,738 car-miles was £2,870, so that, in the eight months, the experiment has cost the department £5 264. The traffic after 9 a.m. has yielded an increased car-mileage of 113,687, an increase of passengers of 64,893, a decrease per car-mile of 0·32, an increase of receipts of £4,345, and a decrease in receipts per car-mile of 0·10d. The additional car-miles have cost £3,520, leaving a net profit on this traffic of £825, instead of £4,345, which would have accrued had not the car-mileage been "pushed up somewhat unnecessarily." Traffic for the whole day shows that an increased mileage of 206,425 has been run, the increase in receipts being £1,951. The Tramways Committee, after receiving the report, decided to continue the present arrangement to the end of the 12 months' trial.

Chile.—The Chilean House of Deputies has authorised a new call for tenders for the electrification of the first section of the State Railways. This section comprises the line from Valparaiso to Santiago, a distance of 117 miles, and the branch line from Las Vegas to Los Andes, a distance of about 28 miles. The waters of the River Aconcagua will be utilised to generate the power required.—*Board of Trade Journal.*

Continental Notes.—ITALY.—It is stated that the Società delle Forze della Maira has just concluded an agreement with the Italian State Railway authorities for the supply of power for the working of the Giovi auxiliary line between Ronco and Sampierdarena (Genoa). This power supply company's hydro-electric works on the Maira, near Dronero, in Piedmont, will be completed in a few months, and have a capacity of 50,000 H.P., and power will also be furnished later on to the Mont Cenis line, as the power station of the city of Turin, near Chiomonte, which is provisionally giving a supply, will eventually be inadequate for the purpose. It is understood that the Minister for Railways has under consideration the extension of electrical working on the State lines. Among others, it is proposed to convert the Riviera railway, between Ventimiglia and Genoa, and the power would be delivered by the Società Negri, which has already undertaken to furnish the energy for the Savona-San Guiseppe railway. Various transformations are also projected in Central Italy, including the Bologna-Florence railway, which climbs to an altitude of 3,250 ft.

RUSSIA.—Application has been made to the Russian Government for a projected electric railway between St. Petersburg and the Finnish frontier. It is proposed to utilise the water power of the River Vonoksa in the generation of the necessary electrical energy. The cost of the proposed line is estimated at 2,950,009 roubles.

Douglas.—It was reported at the meeting of T.C. that, for the quarter ended December 31st last, there was a deficiency on the tramway receipts, as compared with the expenditure, of £1,422. A motion to increase the fares on the cable tramway was negatived, as was also a proposal to purchase a motor-'bus, at a cost of £1,000, to run the service to the Peel Road district.

Dunfermline.—Negotations are at present proceeding between the T.C., the superiors of the new Rosyth area, and the tramways company regarding tramway extensions. At a meeting of the T.C. it was stated that there was every probability of the tramways being extended to Milesmark during the summer. The question of ½d. fares has been brought before the tramway authorites.

Edinburgh.—The Tramways Committee is to ask power from the T.C. to negotiate with the Colinton Tramway Co., and, if thought necessary, with the War Office. The Committee has had an offer of sale from the company of the whole of its undertaking. Formal intimation was made that the company had resolved to apply to Parliament for a prov. order for powers to make a line from Slateford, *via* Fountainbridge to the centre of the city.

Gower.—At Swansea on March 13th the Light Railway Commissioners held an inquiry into an application for power to construct a light railway in the Gower Peninsular. There was no opposition, and all the public bodies interested supported the application, with the sole exception of the Glamorgan County Council. The Commissioners intimated that an exceedingly strong case had been made out, and subject to satisfactory financial arrangements, they would be prepared to grant the order.

Hove.—Considerable correspondence has been going on during the past month between the Hove and Brighton Councils in reference to a suggestion from the latter that a conference should be held to consider the system of overhead equipment to be adopted for the "through routes" in the two towns, which, under the Brighton Corporation Act, of 1912, and the Hove Corporation Act, of 1913, should be completed within two years from August 7th, 1912, together with other works necessary for running the vehicles. The Hove Corporation appointed a sub-committee to meet Brighton, and expressed the opinion that the conference was somewhat premature, on the ground that, unless the B. of T. sanctioned double-decked cars, it would not be of interest to either borough to carry out the trolley system, and also that, owing to recent developments, it should be open to the conference to discuss matters on broader lines than those indicated. Except the conference was upon these lines, the sub-committee did not see its way to attend for any other purpose. To this Brighton replied that its representatives were appointed specifically to attempt to agree on the system to be adopted for the purpose of its Act and the Hove Act. It appeared, the letter continued, that Hove had appointed its representatives to deal with an altogether different matter, and, under the circumstances, in default of its carrying out of the provisions of Sec. 15, Brighton would submit a system for the approval of Hove. On this letter, the Traction Committee of Hove states that it is still quite prepared to confer with delegates from Brighton but it must be on a broader basis than that suggested, and under these circumstances, it has decided to make a full inquiry into the matter, and let the question of a conference stand over for the present.

Ilford.—The tramways general manager has been authorised to purchase a quantity of tramway trolley wire, not exceeding two miles. The centre tramway poles in High Road, from Cleveland Road to Seven Kings Railway Station, are to be removed and re-erected on the footpath. The cost of this work is estimated at £450. The general manager expresses the opinion that, from the point of view of general traffic, he thinks that it would be an advantage to have the poles removed, as there would be less obstruction to other vehicles in pulling out of the way of cars when necessary.

London.—The Metropolitan Boroughs' Standing Joint Committee has circularised all the London borough councils asking them to take action to prevent sanction being given to Clause 16 of the Metropolitan Electric Tramways (Railless Traction) Bill, 1913, which permits the use of trolley vehicles on routes not specified without the consent of the road authority being obtained.

Morley.—The B. of T. has extended, until December 31st next, the period for the completion of the whole of the lines authorised by the Morley and District Light Railways Order, 1901.

Ramsbottom.—There has been considerable delay in proceeding with the work of railless traction construction, but it was announced at the Council meeting last week that the firm who had been ordered to do the work had agreed to finish it by the end of July. The overhead equipment will then be completed, and, in the meantime, the furnishing of the cars and so forth is being gone into by the Council.

Sheffield.—A recommendation has been made that tramway facilities be provided for the residents of Upperthorpe, the intention being to lay rails from the Hillsborough section, up Albert Terrace Road and Oxford Street to Harcourt Road, where they will join the Walkley section.

Southampton.—It has been decided to equip the Corporation tramcars with meters for checking the waste of energy, and the offer of Ferranti, Ltd., has been accepted to supply sufficient meters to equip the whole of the cars on the understanding that at the end of six months they are to be purchased outright at £3 5s. each, or returned without expense.

TELEGRAPH and TELEPHONE NOTES.

Brazil.—The Government has decided upon the erection of wireless telegraph stations at Fortaleza, capital of Céará, and at Porto Murtinho, State of Matto Grosso. The total amount provided is about £26,700. The construction of a special telegraph line between the Federal capital and the State of S. Paulo has also been authorised. The amount provided is about £26,700. —*Board of Trade Journal.*

Canada.—According to statistics published in the *Financier*, the telephone companies in Canada number 683, an increase of 146 during the year. In Manitoba and Alberta the systems are owned by the Provinces. The aggregate capital is $46,276,851, an increase of $6,232,869 over the previous year. The gross earnings of all companies in the year were $12,273,620, operating expenses $9,094,688, and net earnings $3,178,987. The operating expenses were 74 per cent. of the gross. A total of 370,884 telephones are in use in Canada, equal to one for every eight of the population. Employés numbered 12,873, and salaries last year totalled $2,659,641.

Imperial Wireless System.—The Advisory Committee appointed by the Postmaster-General has had before it representatives of Government departments and of those firms claiming to be able to carry out the work. It has also visited wireless telegraph stations under the control of the Government, and intends to visit other installations of importance in the United Kingdom and on the Continent.

Italy.—A second scheme has been submitted to the Government for the expenditure of a further sum of over £2,600,000 on the systematisation of the Italian telephone network, and for the construction of new international lines. Of the proposed new expenditure, £2,097,000 will be allotted to the underground cable network, and £537,000 to the installation of new overhead lines. The scheme is expected to be completed within a period of 10 years.—*Telegrafia e Telefonia.*

Post Office Telegraphs and Telephones.—According to accounts published last week (dated November last), the total expenditure on the telegraphs (including telephones) for the year ended March 31st, 1912, amounted to £6,906,898, while the receipts fell short of this by £796,457. The receipts included a sum of £201,964 in respect of royalties paid chiefly by the National Telephone Co., Ltd., which, of course, will not recur. Adding the annual charge on the purchase price of the telegraphs (£271,691), the total deficit was £1,068,148. The amount expended on the telephones amounted on March 31st, 1912, to £15,266,699, besides £1,586,154 retained by the National Telephone Co. in part payment of the purchase price of their undertaking. The total deficiency since 1869 amounted to £20,889,529; if items of the nature of capital were excluded, this deficiency was reduced to £8,093,489.

Sweden.—The patent rights of the Nya A.B. Autotelefon Betulander Co. have been sold to the Marconi Co., except those for Sweden, for over 2,000,000 kronen. The sale includes the patents previously owned by the French exploiting company. Usufruct rights in Betulander's automatic telephone system are retained by the Swedish Telegraph Administration.—*Affärsvärlden.*

The Telephone Service.—According to a recent announcement, the Postmaster-General will in future accept three months' notice of termination of contract for telephone service.

At a meeting of the Associated Chambers of Commerce last week, a resolution was passed expressing the view that the telephone service should be carried on as a commercial undertaking in the hands of a special authority, and asking the Government to appoint a Select Committee to consider the question.

Trans-Atlantic Wireless Telegraphy.—In reply to a question in Parliament, Captain Norton said that no licence had been given or promised to the Marconi Co. in respect of a further station for trans-Atlantic communication: but the company had been informed that the question of granting a licence for such a station would be considered when a final report had been received from the Select Committee on the contract for the Imperial wireless chain. It was understood that the company was proceeding with the erection of the buildings intended for such a station on a site in North Wales, but it had been warned that its action was entirely at its own risk. Subject to any considerations which might arise out of the recommendations of the Select Committee, and subject to reasonable conditions as regarded non-interference between the various stations, it would be the policy of the Post Office to grant a licence for this purpose to any British wireless telegraph company giving adequate proof of financial standing and technical competence.

CONTRACTS OPEN and CLOSED.

OPEN.

Australia.—May 14th. Generating plant for Darwin Radiotelegraph Station, Northern Territory. See "Official Notices" to-day.

Belgium.—March 29th. Municipal authorities of Ixelles-lez-Bruxelles. Armoured cables necessary for the low-tension distribution service.

Blackpool.—High and low-tension cables and transformer switch pillars. See "Official Notices" March 14th.

Bolton.—March 27th. Materials and stores for the year. Mr. Samuel Parker, Town Clerk, Town Hall. See "Official Notices" March 14th.

Bridgend.—March 21st. One 400-K.V.A. steam alternator and accessories, for the U.D.C. See "Official Notices" Feb. 28th.

Cairo.—March 30th. Tenders are required for the machinery and accessories for the electric lighting of the town of Damietta. Provisional deposit, 2 per cent. of amount of tender; final deposit, 20 per cent. Particulars, Ministère de l'Intérieur, Cairo, Egypt.

Carlisle.—March 25th. Lubricating oils, greases, &c., and cables, for a year, for the City Electricity Department. See "Official Notices" March 14th.

Croydon.—March 31st. Stores for a year, for the Corporation Electricity Department. See "Official Notices" Feb. 21st.

Dundalk.—March 24th. Stores for a year, for the U.D.C. Electricity Department. See "Official Notices" March 7th.

Germany.—April 15th. The Königl. Maschinenbau Amt in Hanover. Tenders for four steam turbines, four three-phase generators, two transformers and a battery of accumulators.

Gillingham (Kent).—March 28th. Stores for a year. See "Official Notices" March 14th.

Hornsey.—March 31st. Natural draught cooling tower for the T.C. electricity works. See "Official Notices" March 14th.

London.—L.C.C.—April 3rd. Reconstruction and rewinding of seventeen 300-KW. synchronous motor-generators and three 500-KW. induction motor-generators. See "Official Notices" March 14th.

April 2nd.—Electrical installation at the Avery Hill Hostels, Eltham, S.E. See "Official Notices" to-day.

BATTERSEA.—April 1st. Coal for a year, for the B.C. Electricity Department. See "Official Notices" March 14th.

Peterborough.—March 31st. 1,023 yards of cable, for the Corporation. See "Official Notices" to-day.

Salford.—March 31st. Stores, &c., for the Corporation Electricity Department. See "Official Notices" March 14th.

Spain.—The municipal authorities of Salvaleon (province of Badajoz) have just invited tenders for the concession for the electric lighting of the town during a period of ten years.

Shanghai.—April 3rd. Extra-high-tension and low-tension switchgear for sub-stations. See "Official Notices" March 14th.

Stalybridge.—4,500 yards E.H.T. three-core lead-covered cable. See "Official Notices" March 14th.

Uruguay.—March 29th. Five electric gantry cranes for Customs warehouses at Monte Video. B. of T. C.I. Department in London.

Wigan.—March 31st. Materials and stores for the Corporation Light and Tramways Departments. See "Official Notices" March 14th.

CLOSED.

Ashton.—The T.C. has accepted the tender of Messrs. Switchgear & Cowans, Ltd., for high-tension switchgear.

Australia.—SYDNEY.—The *Australian Mining Standard* publishes the following list of tenders for electrical machinery and accessories that were before a February meeting of the Electric Light Committee:—

Storage batteries, motor generators, &c.—
N. Guthridge, Ltd.—Alternative tender, No. 1, Sec. B, £12,590; do., No. 2, Sec. B, £12,500.
Ferranti, Ltd.—Formal tender, Sec. C, £6,525.
Noyes Bros.—Formal tender, Sec. A, £39,311; do., Sec. B, £11,085; do., Sec. C, £8,122.
British General Electric Co.—Formal tender, Sec. B, £7,873.
Australian Metal Co.—Formal tender, Sec. A, £32,015; do., Sec. B, £6,247; do., Sec. C, £5,751; alternative tender, No. 1, Sec. A, £32,090; do., Sec. B, £6,343; alternative tender No. 2, Sec. A, £32,695.
Tudor Accumulator Co., Ltd.—Formal tender, Sec. A, £32,090; alternative tender No. 1, Sec. A, £32,770; do., No. 2, Sec. A, £29,080.
Siemens Bros., Ltd.—Formal tender, Sec. A, £32,360, Sec. B, £14,522, Sec. C, £6,342; alternative tender No. 1, Sec. A, £32,710; do., No. 1, Sec. B, £10,858; do., No. 2, Sec. B, £9,205.
Australian General Electric Co.—Formal tender, Sec. B, £11,847; do., Sec. C, £5,184; alternative tender No. 1, Sec. B, £10,247; do., Sec. C, £6,362.
Dick, Kerr & Co.—Formal tender, Sec. A, £32,090, Sec. B, £10,924, Sec. C, £6,525; alternative tender No. 1, Sec. A, £32,770, Sec. B, £10,924, Sec. C, £6,525.
Haes & Eggers.—Formal tender, Sec. A, £36,160.
D.P. Battery Co., Ltd.—Formal tender, Sec. A, £34,810.
Chloride Electrical Storage Co., Ltd.—Formal tender, Sec. A, £37,740; alternative tender No. 1, Sec. A, £34,599.

Transformers.—
British General Electric Co.—£1,020.
Siemens Bros., Ltd.—£1,160.
Australian General Electric Co.—£1,230.
Australian Metal Co.—£1,265 (informal).

Maximum demand indicators.—
Australian General Electric Co.—£163.
W. G. Watson & Co., Ltd.—£308.

Arc lamp contact and suspension gear.—
Lawrence & Hanson Electrical Co., Ltd.—£214.
W. G. Watson & Co., Ltd.—£215.

The same exchange states that the Prahran and Malvern Tramways Trust has accepted the tenders for trucks, wheels and axles, brakes and motor equipments for 16 new cars as follows:—

Trucks.—Noyes Bros. Pty., Ltd., at £67 5s. per truck.
Wheels and axles.—Noyes Bros. Pty., Ltd., at £24 17s. 6d. per set.
Magnetic brakes.—Australian Metal Co., at £60 per set.
Motor equipments.—Australian Metal Co., at £258 per set.

MELBOURNE.—P.M.G.:—
Seven rotary converters, £2,065.—Maritime Wireless Co. (Shaw System), Ltd., Sydney.

BRISBANE.—P.M.G.:—
Glazed earthenware conduits, £1,994.—Brunswick Brick, Tile and Pottery Co.
1,416 tubular cross-arms, galvanised iron, £198.—E. Sachs & Co., Ltd.
15,000 wood cross-arms, 1s. 6d. each.—F. E. Barbat & Sons.
13,500 insulators, porcelain.—Theodore Zwicker & Co.
78 manhole covers and frames, £1 7s. 3d. each.—Balmer & Crowther.

ADELAIDE.—P.M.G.:—
$6\frac{5}{8}$ miles paper-insulated lead-covered cable, £1,070 per mile; $2\frac{1}{8}$ miles, £882 per mile.—Siemens Bros. Dynamo Works, Ltd.
8 miles various ditto cable.—W. T. Henley's Telegraph Works Co.

VICTORIAN RAILWAYS.—
H.D. bare copper cable.—B.I. and Helsby Cables, Ltd.
Electric street railway and tramway crossing, £920.—Sewell & Gaskell.

STATE RIVERS AND WATER SUPPLY COMMISSION.—
One motor-driven centrifugal pump, &c., for Hopetoun, £184.—Robison Bros. & Co. Pty., Ltd.

Bridlington.—The T.C., at a specially called meeting, unanimously approved the recommendation by the Electricity Committee that, subject to the approval of the L.G.B., in connection with necessary extensions at the electricity works, the tender of Messrs. Willans & Robinson, Ltd., for a disk and drum turbine, coupled to a tandem D.C. generator of Messrs. Brown, Boveri's manufacture, amounting to £2,867, be accepted.

Bolton.—The Bolton Electrical Co. has received the contract for installing electric light at premises at 121, Deansgate, Bolton.

Burton-on-Trent.—The tender of Messrs. Richards for installing electric light at Christ Church has been accepted.

Heywood.—The Electricity Committee has accepted the tender of Mr. J. Smith for repairs to the chimney at the electricity works.

King's Lynn.—The T.C., on March 12th, accepted the tender of Messrs. Holdsworth & Sons, Ltd., for a Lancashire boiler, economiser and steam and other piping for the electricity works, at £957.

London.—KENSINGTON.—The Guardians have accepted the tender of the Sun Electrical Co., Ltd., at £20 12s., for an annual supply of electric fittings. Five other tenders were received, at prices ranging from £21 18s. 2d. to £35 10s. 9d.

STEPNEY.—The B.C. Electricity Committee received the following tenders for c.i. chambers, pavement frames and covers for one year :—

J. Every	(recommended)	£69
E. & F. Wright		70
Carron Co.		88
W. Creighton		119

Messrs. Siemens Bros. Dynamo Works, Ltd., have obtained a contract for the supply of "Wotan" drawn-wire and carbon-filament lamps for the ensuing 12 months for the County of London Asylums.

Sunderland.—The T.C., on March 12th, accepted the following tenders on behalf of the Electricity and Lighting Committee :—

B.I. and Helsby Cables, Ltd.—472 yd. low-tension cable.
W. G. Farrow & Co.—Cast-iron troughs.
Brotherton & Co., Ltd.—Pitch and thinning oil.
W. T. Henley's Telegraph Works Co., Ltd.—Switch-pillar fuses, and 24 bifurcating boxes.
I.-R., G.-P. and Telegraph Works Co., Ltd.—440 yd. of 19/20 cable.

West Bromwich.—The T.C. has accepted the tender of Messrs. W. H. Bowter & Co., Ltd., for 10,000 tons of coal for the electricity works.

Whitehaven.—The T.C. has accepted the following tenders :—

Doulton & Co., Ltd.—Earthenware troughs.
Dussek Bitumen Co.—Bitumen.
General Electric Co., Ltd.—Electric lamps.
Veritys, Ltd.—Clear glass wall globes.
W. T. Henley's Telegraph Works Co., Ltd.—Tapes.
B.I. and Helsby Cables, Ltd.—Fuse boxes.
Ferranti, Ltd., the Bastian Meter Co., Ltd., and the British Thomson-Houston Co., Ltd.—Electricity meters.

Worcester.—The City Council has accepted the following tenders in connection with the electricity undertaking :—

B.I. and Helsby Cables, Ltd.—Cables required during the three years ending December 31st, 1915, at scheduled prices.
Heenan & Froude, Ltd.—Extension of coal storage bunkers and existing elevator at Hylton Road electricity works, £930.
Stokes Bros.—Builders' work in extension of boiler house at Hylton Road electricity works, £477.
E. Bennis & Co., Ltd.—Bennis patent improved smokeless chain-grate stoker, £212.
Phœnix Dynamo Co.—350-KW. motor-generator, £690; the company to take out the 100-KW. complete motor-generator set, which cost £475, and for which an allowance of £425 will be made. The balance of £265 will be provided by the sale of an old 120-H.P. engine and obsolete 75-KW. alternator, and of part of the old copper now in stock.

FORTHCOMING EVENTS.

Association of Electrical Station Engineers.—Thursday, March 27th. At 7 p.m. Meeting, to form Birmingham branch, at the Y.M.C.A., Dale End, Birmingham. Meetings to form branches will also be held at Mechanic's Institute, Bradford, on Wednesday, March 19th, at 8 p.m., and at "Amalgamated Society of Engineers," Mount Pleasant, Liverpool, on Thursday, March 20th, at 8 p.m.

Manchester Electro-Harmonic Society.—Friday, March 28th. At the Albion Hotel, Manchester. Last concert of the season.

Institution of Electrical Engineers (Scottish Section).—Annual general meeting postponed from April 8th to April 15th.

THE ELECTRICAL ENGINEERS
(LONDON DIVISION).

WITH regard to the Orders published in our last issue, those interested are requested to note that the arrangements announced for 21st inst. should have been omitted, that date being Good Friday.

NOTES.

The G.E.C. "At Home."—Instead of their annual dinner, which has hitherto been one of the events of the electrical world, the directors this year decided to celebrate the twenty-fifth anniversary of the formation of the company by giving an "At home" to their numerous friends. The difficulty of accommodating so large a gathering was met by engaging the Royal Opera House, Covent Garden, for the evening, and on Saturday last the guests assembled there to the number of over 2,500. The proceedings took the form of an entertainment provided by a selected company of leading artistes and humorists of the day; the auditorium was furnished with small tables and was occupied by the male portion of the audience, while the rest of the house was devoted to lady visitors, of whom a large number were present. Members of the staff of the G.E.C., drawn from all parts of the country, and from various foreign and Colonial centres, acted as stewards, there being a steward to each of the 80 tables. Smoking was permitted in the auditorium, and abundant provision to this end was made, while an elaborate and appetising *menu* was served at the various buffets. The arrangements, which were in the able hands of Mr. H. Clifford Palmer as organising manager, were in every way all that could be desired, and nothing was left undone to ensure that every guest should, in the words of the wish expressed on the flyleaf of the programme, "Spend a very pleasant evening." The Chairman, Mr. H. Hirst, with the Vice-chairman, Mr. E. G. Byng, the general manager, Mr. M. J. Railing, and their co-directors, Dr. A. Railing and Messrs. L. G. Byng and F. S. Sells, mingled with their guests, but there was no formal reception, and no speeches were made.

Amongst those present were most of the leading lights of the electrical world, including Mr. Duddell, President of the I.E.E., Dr. de Ferranti, Prof. Perry, Dr. Sumpner, Messrs. Sparks, Highfield, McMahon, Wright, Sheppard, Slingo, &c., as well as many distinguished representatives of the professions and Government departments, such as Sir George Moore, Sir John Taverner, Mr. A. Colefax, Mr. A. Walter.

The orchestra, under the direction of Mr. Herman Finck, needless to say, fulfilled its duties with the highest efficiency. The programme included items by Harry Dearth, the Sunshine Girls, Miss Wish Wynne, Mesdames Olga and Elgar Hudson and Eli Hudson, Miss Clarice Mayne and "That," Edmund Payne and Geo. Grossmith, Miss Ruth Vincent, Harry Tate, Miss Lydia Kyasht and Theodore Kosloff and Barclay Gammon; all these, obviously, were sure of a cordial reception, and fully maintained their respective reputations; but without detracting from the merit of the other performers, we cannot refrain from expressing appreciation of the delightful feast of harmony, perfect in every detail, with which the audience were regaled by that charming trio, Mesdames Hudson and Mr. Hudson, which alone would have rendered the occasion a memorable one. Interspersed amongst the musical items were several series of bioscope pictures representing the various works of the company and the operations carried on therein, and we do not hesitate to say that these were amongst the most interesting features of the entertainment. The Witton staff at work and at play, the manufacture of the Osram lamp, the making of telephones, and a variety of other subjects, including the offices of the G.E.C. both at home and "all-round the world," were shown in quick succession, and the views bore telling witness to the wide scope of the company's operations and to the diversified activities of the multitude of workpeople to whom it gives employment. Altogether the entertainment was in the highest degree successful, without a single jarring note, and the company is to be congratulated upon the thorough and efficient manner in which it carried out this novel and original birthday party.

We are pleased also to offer our congratulations to the company on the completion of its first quarter century, a period which covers practically the whole history of electrical engineering apart from the telegraph branch. Starting on a modest scale, the company has continuously grown until it is now the largest electrical manufacturing company in the kingdom, with a capital of over 1 million sterling, and employing nearly 10,000 hands, while it has also established subsidiary companies in South Africa, Australia, New Zealand, India, South America, France, Belgium and Spain. It is capable of providing almost everything electrical, from the equipment of a generating station to an electric bell, and owns factories at Witton and Edgbaston (Birmingham), Salford, and London. A specially commendable feature of the company's policy is the care shown for the well-being of its employés, not only in the factories, but also outside them, provision being made for their entertainment and recreation, of which full use is made by the workpeople. Athletic grounds are provided for all the works and for the head office; at Witton, in addition to cricket and football, grounds are set apart for bowls, tennis and hockey, and a scheme is on foot for the erection of an institute or club house, affording accommodation for recreation and refreshment on a comprehensive scale. Social clubs have been organised at most of the works. The G.E.C. athletic clubs have attained distinction both in London and in the provinces, and the Lamp Works Fire Brigade has scored a long list of triumphs. The fortunes of the company are bound up with those of British industry, and we cordially wish that the completion of its second quarter century may find it in a position in every way as satisfactory, but many times more prosperous even than the present.

Electric Car-Lighting Competition.—A cup value £50 for the best electric car-lighting installation in an R.A.C. certified trial has been offered to the Royal Automobile Club by *Country Life*, and accepted, a condition being that there shall be at least four entries for the competition. The judges will be the Technical Committee of the club. The following are the conditions of the competition :—

1. The whole equipment must be entered for trial and must be properly installed upon a car.

2. The distance run upon the road shall not be less than 2,000 miles.

3. All lamps (not less than two head-lamps, two side-lamps, and one tail-lamp) shall be alight at the same time and for at least six hours every day.

4. The Technical Committee of the R.A.C. shall decide which of the performances as shown in the trials' certificates is the best.

Entries will be received by the R.A.C. under the general regulations for certified trials, until September 15th next, any equipment entered before that date, and completing its trial before October 15th, 1913, being eligible for the prize.

The following data (*inter alia*) will appear upon the certificates, and any equipment entered for a certified trial in order to compete for the prize will be subjected to such tests as may be necessary to obtain such data: (*a*) Full description of equipment entered, including battery and its fitting to car, together with weights of parts, and the wattage and candle-power of the lamps; (*b*) total distance run; (*c*) number of lamps expended; (*d*) wear of parts during trial and general condition after trial of the equipment, including accumulator; (*e*) the behaviour of the equipment at different car speeds on the various gears at Brooklands; (*f*) the convenience of the adjustments of the dynamo and control of the lamps

Ghent Exhibition.—Preparations are advancing for this Exhibition which opens on April 26th. No less than 130 Congresses are to be held during the six months that it is open. Of these about one-half are to be international. Most of these 130 Congresses will last several days, and there will be occasions when as many as five will be sitting at the same time. But we are informed that there will be plenty of accommodation, for an indefinite number might find room in the great permanent building, the Palais de Fetes et d'Horticulture, which is one of the most striking sights of the whole Exhibition. The span of its main hall is far greater than that of the Crystal Palace; the hall contains 3½ acres, and the second or small hall 2 acres.

Ghent is, as yet, not nearly so well known to the British public as it should be. To the business man it is the most thriving of Belgian commercial towns, the centre of Belgium's cotton and linen industries; to the general public, a city full of old monuments and relics of the day when, as capital of Flanders, the town was in the forefront of mediæval commerce and warfare. But few business men even recognise the important part which Ghent plays to-day in Belgium's commercial prosperity. In addition to being a port, Ghent is a great and growing manufacturing town in the centre of Belgium. In the cotton factories there are twice as many spindles as in the whole of the rest of Belgium; Ghent linen factories employ yet more hands than the cotton; Ghent machinery is exported world wide. To build an hotel to hold 1,000 guests on purpose to prepare for the rush of visitors to the Exhibition, and then to pull half of it down again when the Exhibition closes, is one of the striking pieces of enterprise which the municipal authorities of the town have undertaken. The hotel is in no way a temporary structure, but brick-built throughout, and the remaining half will continue under the management of the town as a station hotel at the new railway station on the main line from Ostend to Brussels. This station, the Gare St. Pierre, may almost be described as an Exhibition enterprise too, for it is just on the edge of the grounds, and the work has been specially put forward so that it may be ready for the Exhibition traffic.

The special hotel is being built to provide rooms at a fixed and reasonable price for visitors. But apart from the erection of this hotel, a "bureau de logement" has been formed to inspect and classify all the private apartments available. The price of these, 3 fr., 5 fr., 6 fr., 10 fr., or 15 fr. for the night and breakfast, is also fixed by the bureau, so that the keepers of hotels and boarding houses will not be able to raise their charges to famine rates in the face of this competition. This bureau, which is not a business concern, and has no financial interest in the work, will have offices at both the railway stations and at the Exhibition, and on applying there, visitors will be given the addresses of vacant rooms at the price selected. As these will all have been inspected and priced by the Committee, there will be little trouble in finding suitable accommodation. In order to provide for the visit to the Exhibition of large parties from workmen's clubs and institutes, the Bureau has also hired a number of large halls, and is fitting them up, with the assistance of the military authorities, as dormatories where as many as 100 or 150 men can be lodged at a time. The charge for these dormatories will only be sufficient to cover the expenses, but arrangements will have to be made beforehand with the Bureau de Logement. Yet another fact which should prevent any great rise in prices in Ghent is the nearness of Brussels, Bruges and Ostend. Bruges can be reached from Ghent by train in 35 minutes; Brussels in 50 minutes; and Ostend in 60 minutes.

It is interesting to learn that a contract has just been signed by the Zeppelin firm and the directors of the Exhibition for a regular passenger service from Dusseldorf to the Exhibition grounds. The service will be maintained throughout the months of August, September and October, and the fare for the flight, which is about 130 miles, will be £14.

Breach of Colliery Rules.—At Heanor on 10th inst., George Maxwell, collier, of Dunstead Road, Langley Mill, was summoned by Henry R. Watson, manager of the Butterley Co.'s collieries, for a breach of the colliery rules on February 21st.

According to the report in the *Nottingham Daily Guardian*, defendant was employed at the Ormond Colliery, Loscoe. On the date named he opened an electrical switch and applied a piece of wire, which had the effect of making a short-circuit, which caused a flash. The colliery was one in which safety lamps had to be used and a great deal of danger might have been caused, not only to the defendant and his fellow-workmen, but to the mine. The wire was insulated at one end, and so caused no injury to the defendant, but it appeared to be a case of foolhardiness. Mr. Watson said the voltage was 650. If the wire had been wet or the insulation in any way defective, the defendant might have been instantly killed.

Mr. Robinson said the lights went out in the pit, and work was stopped for 10 minutes. Defendant, in pleading guilty, said he did not know what he was doing; he was "acting the fool." A fine of £1, with 16s. costs, was imposed, the alternative being 14 days' imprisonment.

Parliamentary.—Private Bills.—It has been decided that the following, amongst other Bills, shall originate in the House of Lords: Bradford Corporation, Brighton Corporation, Central London Railway, City and South London Railway, Ely Valley Gas and Electricity, Hastings Tramways, Hove Corporation, Huddersfield Corporation, Leeds Corporation, Leicester Corporation, London Electric Railway, Metropolitan District Railway, Metropolitan Railway, Porthcawl and District Gas and Electricity, and Wimbledon and Sutton Railway.

Petitions have been deposited in the Private Bill Office against the following private Bills: Brighton Corporation, Central London Railway, City and South London Railway (numerous petitions in this case), Hastings Tramways, Hove Corporation, Leicester Corporation, London Electric Railway (11 petitions), Metropolitan District Railway, Metropolitan Railway (33 petitions), Wimbledon and Sutton Railway, Ely Valley Gas and Electricity, Porthcawl and District Gas and Electricity, London and South-Western Railway, Morley Corporation, Folkestone, Sandgate and Hythe Railless Traction, Crowborough District Gas and Electricity, L.C.C. (Tramways, Trolley Vehicles and Improvements) (many petitions), Metropolitan Electric Tramways (Railless Traction), Mexborough and Swinton Tramways (Railless Traction), Western Valleys (Monmouthshire) Railless Electric Traction, Chesterfield Corporation Railless Traction, Rhondda Tramways (Railless Traction), Coventry Corporation, Southport Corporation, Tottenham and Edmonton Gas.

Automatic Time Signals at Rugby School.—An ingenious device, known as the "Universal" programme ringer, has been installed at Rugby School for the purpose of controlling the time-table of class periods, so that the sessions of the entire school are now directly regulated by the headmaster to the nearest half-minute of Greenwich time. The apparatus comprises a perforated band of thick paper, 10 in. wide, which passes horizontally over trains of brass drums, so that at the appropriate instant electrical contact is made through the holes in the paper between a spring pointer and the surface of the drum. Signals are by this means transmitted to ring electric bells in various parts of the building. There are two sets of eight electrically-insulated disks, each set mounted in fixed relationship on a spindle. One disk is reserved for operating a daily change of mechanism, and other disks are assigned to the separate days of the week, the correct wheel being brought into the proper circuit automatically by the above mechanism.

The whole mechanism moves, carrying the perforated paper roll forward, every 30 seconds, by means of an electro-magnetic impulse device controlled by a master clock, which at the same time operates secondary "Pulsynetic" electric impulse clocks in the classrooms and elsewhere. There are eight signal bells and nine "Pulsynetic" clocks in the school. A simple means of perforating the roll is provided, so that additions can be made to the time signals. Parts of the system can be temporarily cut out of service by means of local switches.

An entire change of programme, as, for instance, between summer and winter, is effected by changing the roll. Power to work the ringer is supplied by a battery of Leclanché cells, which need but little attention. The ringer has been working satisfactorily since October last, and was erected to the design of Mr. Hardy Parsons, managing director of Messrs. Gent & Co., Ltd., of Faraday Works, Leicester, whose firm carried out the work.

Electricity in the Reclamation of Marshes.—For peat getting by machine, a species of dredger is employed. In a special apparatus made by Messrs. Strenge (Oldenburg), the collecting tackle is driven through a worm and worm wheel from an electric motor, while a second motor drives the whole collector to and fro on a 13-ft. spindle. The wet peat collected is carried by a chain conveyor, from the trough into which it is first thrown, to an electrically-driven press. Thence the peat issues as a uniform pulp which flows along two troughs, and is distributed by electrically-driven "spreaders" over the surface of the drained land. The whole apparatus runs on broad heavy beams, and one of the motors it carries drives it forward in the direction of the channel to be dredged in the bog. The scattered peat-cake is (first by hand and then by an electrically-driven cutting machine), cut into sods which are superficially dried and collected in small heaps. When the peat is dried to about 30 per cent. moisture content, it is collected in trucks and hauled by a small petrol loco. to neighbouring works, where it is stored in bunkers, or immediately delivered to the stokers, according to the needs of the case.

Another method of peat getting is practised by Messrs. Dolberg. Labourers dig the peat from the bog and throw it into a conveyor trough, whence an elevator carries it to a machine in which two oppositely rotating worm shafts (driven by a 12½-H.P. electric motor) masticate the peat and deliver it through a mouth-piece, where it is cut into sods. The latter are then carried on timber frames to the drying fields. Such a machine will deliver up to 80,000 sods in 10 hours.

The Wiesmoore electricity works depends entirely on the combustion of peat for steam-raising purposes, and, incidentally, is rendering the community a valuable service by cultivating the bog land from which it collects its fuel. Main canals are cut, into which the bog water drains, and a system of tributary ditches and furrows is laid out, the drained areas being then sown with grass seed. The grass binds the soil together, and the smaller drainage furrows can soon be replaced by drainage pipes, which are then covered up. The reclaimed land is next ploughed electrically—a 50-H.P. motor, driving ploughing tackle, being supplied through high-pressure lines and a 60-K.V.A. transformer. After ploughing, the land is harrowed, rolled, manured and sown, electrical energy being used for power purposes throughout.

About 12½ acres can be ploughed, 25 acres harrowed and 37 acres rolled per diem. The cost of reclamation and cultivation averages £12 per acre. As far as possible, the reclaimed land will be leased in holdings of from 15 to 25 acres each, and the incoming population will be collected in villages, which will then form an admirable load for the electricity station. It is expected to realise 8·25 per cent. profit from this overland scheme.—*E.T.J.* and *Eng.M.*

Lamp-making on the Cinematograph.—On Monday afternoon at the studio of Messrs. Pathé Freres, Ltd., in Wardour Street, W., at the invitation of Messrs. Siemens Bros. Dynamo Works, Ltd., Dalston, we had the pleasure of attending a private exhibition of a film showing the processes of manufacture of "Wotan" and tantalum drawn-wire lamps.

We were privileged to make a tour through the different departments of the lamp works at Dalston without the usual discomforts attending works' visits. The various operations (hand and machine) connected with the preparation of the filaments, bulbs, and the fitting together of the complete lamps, also their subsequent testing, packing in cartons and dispatch, were shown with great effect. The strength of filament was demonstrated in several ways, including the suspension of weights therefrom, and the handling of cases packed for carrier, while from the illumination point of view a domestic scene illustrates the effects of such brilliant lighting upon an average household.

Heavy-Service Lampholders and Adapters.—Referring to the recent correspondence on this subject in our pages, Mr. L. Hamilton writes that he has just seen a new type of lampholder, which has been produced as a result of these letters. He says:—"As the invention is, I understand, now protected, I may say it is really an ordinary type of bayonet holder, but instead of the plungers being actuated by springs they are made solid with the terminals. The socket, which is screwed as usual on the outside, has straight slots instead of the bayonet type of slot, and the tops of the solid plungers are bushed with small balls of fine copper wire to form cushions, so as to make good electrical contact with the standard type of lamp-cap terminals. On the outside of the screwed socket there is a screw cap which consists of a screwed ring, very like the ordinary shade-carrier ring, and it has a plain tubular extension with an inwardly projecting flange at the end without slots, for gripping the pins of the lamp cap. In placing the lamp in position, the flange of the screw cap is first passed over the side pins in the lamp cap, the lamp is then placed in the socket, the side pins being in the slots in the socket, and the screw cap screwed home, when the lamp terminals are pressed hard on to the cushions on the solid plunger tops."

Picture Palace Lighting.—The Angel Picture Palace at Islington, which, we understand, is the largest and latest in London, is fitted throughout with Pope's "Elasta" wire lamps, ranging from 5 to 600 c.p.

Institution and Lecture Notes.—Institution of Electrical Engineers.—At the meeting on Thursday last, the president announced that in future, in order to make the proceedings more quickly available, especially to the provincial members, the *Journal* would be issued at fortnightly intervals (during the session only), in quarto size, without advertisements.

(Birmingham Section).—The sixth annual dinner was held on Friday evening last at the Grand Hotel, Birmingham, Mr. A. M. Taylor, chairman of the Section, presiding.

The toast of the King having been duly honoured, the chairman proposed the Institution of Electrical Engineers, pointing out that it had passed its 40th year, although he hoped it had not passed the prime of its life. It was thoroughly representative of the industry and very much alive. An active Council and President had combined to further its objects, and he took the opportunity of congratulating the President on having been nominated for a second year of office, which he was sure would be a successful one.

The President, in replying, referred to the steady growth of membership of the Institution, mentioning that the raising of the subscription had had the curious effect of increasing the number of applications for admission, as it had done once before, when there was no question of an examination in the future. He reassured those present as to the character of the proposed examinations, which would not be academic, but suited to practical requirements. The Institution had decided, probably at the end of the year, to issue the journal fortnightly, and he hoped in this way they would keep more closely in touch with members scattered over the country.

To Major W. A. J. O'Meara fell the toast of "The Birmingham Local Section." He mentioned that a visit to Birmingham had been considered an essential part of his education as a Royal Engineer, and referred to various incidents in his active service on the Indian frontier, which showed the extent of Birmingham's trade connections, even in little known countries. The I.E.E. had followed the nation in the matter of colonising, and he thought there was something of military organisation in its arrangements. Mr. C. E. C. Shawfield briefly responded.

Prof. Gisbert Kapp proposed "Our Guests." He was very glad that Dr. Ferranti, who was one of themselves, was also a guest. Electricity was the handmaiden of every other industry, and it was well for them to welcome mechanical engineers, municipal representatives and others at their gatherings; he wished it were possible to offer the guests an electrical feast with speeches of telegraphic brevity. Dr. S. Z. de Ferranti said he was replying to the toast partly as a visitor, but more "because he always did it." As regarded their Local Section, he was reminded that Wolverhampton had had a good deal to do with his early career. In those days each arc lamp had its own dynamo, but a very big machine would run six arc lamps. He recalled having been sent out to light an exhibition at Wolverhampton in 1880, where a portable engine plant supplied four arc lamps and 40 incandescents, and where during the first week there was not a single evening without some kind of shut down. He agreed that electricity was entering into every other industry, and thought that if the price of energy could only be reduced below a certain critical figure it was difficult to understand how the various industries could avoid the use of electricity. It would be greatly to their advantage in the future to turn all their coal into electricity.

After the toasts a short, but interesting, entertainment was provided, in which the efforts of Mr. J. Woodward at the piano, the recitations of Mr. W. E. Warrilow, and the conjuring of Mr. E. Hermann were greatly appreciated. Music was provided during the evening by the G.E.C. orchestral band, and the proceedings concluded with a vote of thanks to the Chairman, proposed by Mr. Maurice Solomon.

Institution of Mechanical Engineers.—The rules for graduateship and associate membership examinations have now been issued. The first examinations will be held in October next, and afterwards twice annually. Intending candidates can obtain particulars from the Secretary, Storey's Gate, S.W.

Institute of Marine Engineers.—The annual meeting of the Institute was held on March 7th. A net increase in the membership of 66 was recorded, bringing the total number on the roll up to 1,350. It was stated that the negotiations for the acquisition of a site on Tower Hill were now completed, the total amount subscribed to the special fund being £6,045; £197 was added to the revenue account during the year. Mr. Thomas L. Devitt was unanimously elected president for session 1913-14, Mr. Jas. Adamson hon. secretary, and Mr. Alex. H. Mather hon. treasurer.

Illuminating Engineering Society.—On Tuesday, April 15th, a paper on "Standard Clauses for a Specification of Street Lighting" will be presented by Mr. A. P. Trotter at a joint meeting of the Illuminating Engineering Society, the Institutions of Gas and Electrical Engineers and the Institution of County and Municipal Engineers. Advance proofs will shortly be available, and can be obtained by those wishing to join in the discussion on application to the hon. secretary of the Illuminating Engineering Society (Mr. L. Gaster, 32, Victoria Street, London, S.W.).

Appointments Vacant.—City electrical engineer, for the Carlisle Corporation (£500); electrical mechanician, for the Postal and Telegraph Department of the East Africa Protectorate (£200). See our advertisement pages in this issue.

Inquiry.—A correspondent wants condensers for voltages from 100 to 2,200, to improve the power factor on a 60-cycle single-phase system.

Proposed Strike at Aberdeen.—The local branch of the Electricians' Union has petitioned its National Executive for permission to strike if its demand for an increase of a 1d. per hour is not conceded.

Legal.—In the City of London Court, on Monday, before Judge Lumley Smith, K.C., and a jury, Messrs. Watson, Marsh & Co., electrical engineers, 347, High Road, Brondesbury, claimed £60 3s. 8d. against Messrs. Claytons, tailors and clothiers, 33, Fenchurch Street, Tooting, and elsewhere, for supplying four Sunshine arc lamps with outside cases stoved and highly enamelled in green shade and with special protective varnish. Defendants paid £46 17s. into Court, with a denial of liability, and said that in any event that was enough to satisfy the claim. Mr. Brandon appeared for the plaintiffs and Mr. Samuel for the defendants. Plaintiffs' case was that defendants wanted blaze lamps exactly the same as those outside the premises of Messrs. Lockwood & Bradley, Oxford Street. They quoted £65 for these, and defendants said that it was too much. Some alterations were made to reduce the price, and defendants had to wait three months for the lamps, as they came from "the only place where things come from nowadays—Germany." Defendants had asked them to quote for £100 more work, but that had been declined in the circumstances. Defendants' case was that the plaintiffs had never completed their work, and therefore were not entitled to more than the amount paid into Court. The bands of copper were not of the quality stipulated for. The jury stopped the case, and found for the plaintiffs for the full amount claimed.

Industrial Projects in Russia.—The industrial journal *Norden* states that a Belgian company has recently obtained about 20 concessions for electric tramways and lighting in various places in Siberia and Central Asia, while another group of Belgian financiers is contemplating the erection of large factories for the manufacture of woodwork at Novoborissow, the necessary sites having already been acquired. An English company which has obtained a concession for the harnessing of a large waterfall and the building of an electrical power station at the river of Terek in Caucasia, is said to intend to utilise the electrical energy derived from same for the purpose of connecting the towns of Vladikavkas, Natchik and Kislovoysk by means of electrical tramways. The Imperial Railway Committee are now examining a project laid before them, in which it is proposed to supply the province of Ferghana, the leading cotton-producing district in Central Asia, with a complete system of railways. The total capital expenditure of this project is estimated at £1,283,333. The Russian State Bank has decided to distribute 71 new corn elevators in various places, which will be erected and installed in good time to deal with the crop in 1916. The elevators are to be capable of dealing with 772,800 tons of corn. It is proposed in connection with this project to organise a special department of elevators, to which will be attached a technical staff.

Annual Socials, &c.—The Devonport Dockyard Electrical Apprentices' and Ex-Apprentices' Association held their annual social and dance at the "Criterion" Restaurant, Keyham, on Saturday, March 1st. The evening was spent in a very pleasant manner, beginning with games interspersed with singing and music, and after refreshments, dancing was indulged in from 9.30 till midnight. Most of the officers of the department were present, and credit is due to the secretary and committee for carrying out the arrangements.

Association of Electrical Station Engineers.—A meeting was held last week at the Y.M.C.A., Bothwell Street, Glasgow, the object being the formation of a branch of the above Association for Glasgow and the West of Scotland. There was a representative attendance, and a resolution was unanimously passed that a branch be formed. Mr. A. W. Lamont was appointed hon. secretary, and after some discussion, it was decided not to appoint a permanent committee until the next meeting, but until that meeting a provisional committee will look after the interests of the Association. The next meeting was arranged for April 2nd, same place as above at 7.45 p.m.

The Marconi Libel Litigation.—Before Mr. Justice Darling, in the King's Bench Division on Monday afternoon, Sir Edward Carson, K.C., applied that the libel actions by Sir Herbert Samuel and Sir Rufus Isaacs against *Le Matin* might be in the list for hearing on Wednesday. The paper, he said, had already published an apology, so that the defendants did not intend to contest the case, but, having regard to plaintiffs' public capacity, it would be necessary to put both Sir Rufus Isaacs and Sir Herbert Samuel in the witness box.

His Lordship directed that the action should be in the list next Wednesday.

Electric Car Construction in Great Britain.—It is reported that the Arrol-Johnston Car Co., Ltd., of Paisley, makers of the Arrol-Johnston petrol cars, have secured the sole concession for this country from Mr. F. J. Monnot, of 41, Great Portland Street, London, W., for the construction of electric pleasure cars, fitted with the Edison battery. The new vehicles are expected to make their appearance early in the 1914 season.

ELECTRICAL DEVELOPMENT IN PERU.

In considering the posibilities of expansion of trade abroad, one is always apt to confine attention to countries which, because of the development obvious in them, are "in the public eye," and to forget that in the less advanced countries the greater opportunities often exist. Only the favoured few realise the advantages of opening up relations with these countries, and although they probably risk much, they undoubtedly gain a very great deal in the long run. The countries which are just beginning to open out are eminently suitable for trade, particularly in engineering and electrical lines; they have little to pull down before they build up, they are not hampered with work carried out on obsolete lines, consequently they are easily able to adopt the newest and most up-to-date principles. In South America, Argentine and Brazil, for instance, form the centre of our operations, whereas, in the smaller countries such as Peru, Bolivia, Columbia, &c., where the same natural advantages obtain, and where competition is not nearly so keen, we attempt but little.

That the natural advantages of Peru, from an electrical point of view, are realised, and developments already being effected, is shown in a report from Peru recently made to the American Government. This report points out that about 26 rivers of more or less importance flow into the Pacific Ocean, descending from the Andes at an average altitude of 15,000 ft., and rarely exceeding 100 miles in length. These rivers are more or less torrential, and can, therefore, furnish abundant power, both in the coast region and at their sources in the heart of the mountain ranges. Many cities of Peru obtain their power for lighting purposes, &c., from hydro-electric plants, the largest being those near Chosica and Lima on the River Rimac, furnishing Lima, Callao and their suburbs with about 70,000 H.P., and that of Charcani, near Arequipa, furnishing 1,000 H.P. Water-power plants are also plentiful in all the mining districts, with capacities varying from a few horse-power to 1,000 H.P. Some of these transmit energy to points up to 12 miles distant. There is thus plenty of opportunity for the mines to adopt electricity for power purposes, and there should be a large field for expansion of trade on these lines. As a rule there is more fall than volume of water, and Pelton wheels are used. The rivers flowing into Lake Titicaca are confined in the high plateau between the two branches of the Cordillera. They are torrential only near their sources, becoming slow-flowing streams on the more level plateau, but with a large volume of water. On the Atlantic watershed where the immense basin of the Amazon is formed by numberless rivers, the amount of available water-power is so vast as to be inconceivable. These precipitous rivers fall from 3,000 to 15,000 ft. in from 30 to 50 miles. Concessions of water for generating power as well as for other purposes are mainly governed by the Mining Code, each application being considered on its merits by a delegation appointed for the purpose. There is no tax whatever on this kind of concession.

As regards electric railways and tramways, the most important tramway system in Peru is the Associated Railway, Light and Power Co., of Lima, commonly called the Electric Trust (Empresas Electricas Asociadas), which has the monopoly of the three industries for Lima, Callao and their suburban towns. Its water-power stations are located near Chosica and at Santa Rosa, on the Rimac River, with auxiliary steam plants for cases of emergency. The dividend of this company was raised to 1¾ per cent. for 1910, as against nothing for 1909, and one-half of 1 per cent. for 1908. This increased prosperity was chiefly brought about by the purchase in 1909 of the old National Line to Chorillos, and the suppression of its disastrous competition. The use of the £30,000 received from the sale of the Encarnacion station property in Lima for the redemption of outstanding debentures brought about an annual saving in interest of £1,500. The Electric Trust has a paid-up capital of £1,500,000, and its profits for 1911 amounted to £100,000, as against £80,000 in 1910. On June 21st, 1911, was completed the organisation of the Sociedad Electrica del Cuzco, Ltda. (Electric Co. of Cuzco, Ltd.). The board of directors was elected from representative Arequipa business men, and the company was formed to supply electric light and power to the City of Cuzco, the ancient Inca capital and present terminus of the main division of the Southern Railway, on the route of the proposed Pan-American line. The plan is to take water from Lake Chincheros by canal, or more likely, to go east of Cuzco and use the waters of the Vilcanota River. Plans for the installation of electric light and power in Cuzco are said to have been approved by the President.

By a Federal decree of August 11th, 1911, a private joint-stock company, the Compania de Tranvia Electrica de Arequipa, was recognised as the concessionaire for the construction and operation of the electric street railway system of Arequipa, by virtue of the assignment to it by the Crédito Urbano de Arequipa, then in liquidation, of the contract of May 13th, 1910, entered into for the purpose indicated. According to a local publication, the actual construction work and laying of the rails on the Arequipa tramway lines was to begin in February, 1912, 8·7 miles of single track being comprised in the original installation. Sixty-pound T rails were to be used, with steel poles and brackets for the overhead construction. Power was to be taken from the Arequipa Electric Co., whose power station was then being enlarged to provide the extra capacity, the current being transmitted from Charcani.

The Compania de Tranvia Electrica de Arequipa was incorporated under the laws of Peru with a capital of £30,000 in fully-paid shares, absorbing the urban railway system which operated the horse tramways since 1890. A bond issue of £75,000 was said to have been taken up by a syndicate of bankers which included the Bank of Peru and London, the Italian Bank, and W. R. Grace & Co.

Increase of business led the Arequipa Electric Co. to erect an additional power plant at Charcani to include two new hydro-electric units of 330 KW. each, the construction being well advanced both on the new canal and the building. The machinery will be installed by the end of this year. A new transmission line is being erected between Charcani and Arequipa, doubling the present capacity and assuring the continuance of service in case of breaks.

The gross income of the company for 1911 was £16,000, and the net income £11,000. A dividend of 10 per cent. was paid on a capital of £60,000. The capital has since been increased to £75,000. Favourable credit arrangements were made with the Banco Aleman Transatlantico, and the income is expected to be materially increased through the consumption of power by the new Arequipa Electric Tramways Co. mentioned above, for which purpose the additional plant was necessary.

There has also been considerable expansion in the adoption of wireless telegraphy. In March, 1912, the wireless telegraph offices of Callao and Lima, under the direction of the Department of Posts and Telegraphs, were thrown open for public use for communication to and from vessels at the following rates: Telegrams, in Spanish, in either direction between the stations in Lima and Callao and steamers, up to 10 words, 25 cents, each additional word, 2½ cents; telegrams in other languages or in code, double rates. Double rates are also charged between other Government telegraph offices and steamers in either direction, or over the wireless line to or from the eastern part of the country, adding the rate of that line to the Lima or Callao rate. These rates are in addition to the charges of the companies supplying the services aboard steamers, which are collected in advance with the rate for the Government service.

The direct wireless service now in operation between Iquitos and Lima is under the direction of the Department of Public Works and Development.

In the summer of 1912, the Government ordered four new wireless stations, to give communication between the Southern Railway's station of Tirapata and ports in the Madre de Dios region. It is also proposed to place several stations along the coast and at points in the interior difficult of access by wire lines. Since the beginning of this year, wireless equipment has been installed on the naval transport *Chalaco* and on the *Limari* and other steamers in the Chilean trade. At the General Post Office and Telegraph Office in Lima, there has been installed a radio-telegraphic station, the apparatus for which was all made in a small workshop belonging to that branch. It has a radius of 300 miles, which will be increased to500 miles.

According to official information, there were in active operation in Peru in 1912 the following radio-telegraphic stations:—At Lima a 10-KW. Telefunken system and a 2-KW. Peruvian system; at Iquitos, a 10-KW. Telefunken system; at Callao, a 2-KW. Peruvian system; and at Puerto, Bermudez, Masisea, Orellana, and Requena 2-KW. Telefunken systems.

MESSRS. PARMITER, HOPE & SUGDEN'S WORKS, MANCHESTER.

About ten years ago Messrs. Parmiter, Hope & Sugden moved into a small building in Ellesmere Street, almost opposite their present works.

In the interval the growth of the firm's switch and fuse business necessitated a removal into larger premises, which, it is satisfactory to know, are still being extended, and constitute the Hulme Electrical Works, as we know them to-day, a building with 100 yards of frontage and several floors in height.

The works are laid out for the production of standard lines of ironclad switchgear and distribution fuseboards for power and lighting, and the mention of the Hope "honeycomb" fuse and "bi-metal" fuse wire will be sufficient to remind our readers of the firm's activities particularly in fuse-gear. The business has, in fact, been built up on specialisation and standardisation, in conjunction with originality in design, and some idea of its scope can be gathered from the output of about 1,000 switches and fuses per week, a large percentage of which goes abroad, chiefly to Australia and South Africa.

The works comprise, on the lower floor, an erecting shop for power distribution boards, with examining, painting and packing departments, and general stores for parts and fittings adjoining. The stores receive their complement of machined parts for stock from the general machine shop on the next floor—this section of the works being fully equipped with necessary tools for dealing with the class of work undertaken by the firm.

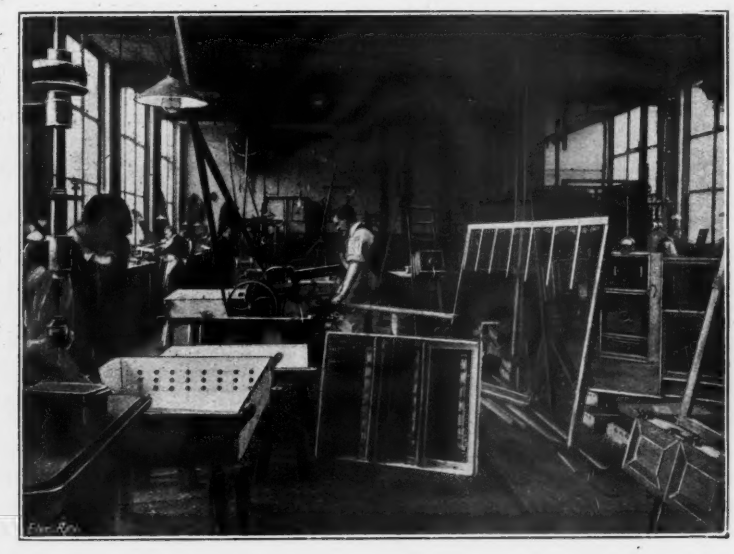
A further floor houses another section of the works devoted almost exclusively to small switch work of a cheaper

The Hulme Electrical Works of Messrs. Parmiter, Hope & Sugden.

type—one outstanding feature of this department is the enormous output of the familiar small K type switches, a pattern of switch which, we understand, was originally designed by the firm, and has undoubtedly become very popular.

Another department is devoted to small fuse fitting, and here also the firm's well-known bi-metal fuse wire—an alloy fuse wire with a copper core—is dealt with.

A fully equipped test room is provided, and extensive general and drawing-office accommodation. In the course of our visit a considerable order for three-phase "unit" distribution boards for a Yorkshire mill was passing through the works. The Hope unit system consists of cast-iron fuse-boxes so constructed that either end can be removed and additional fuse-boxes added, the bus-bars being extended to suit. These and other types of fuseboards are built up of standard single fuses on black china bases, each one fixed to the case by a central screw, and therefore easily detachable and replaceable.



The Erecting Shop for Distribution Boards, &c.

Small Fuse Department.

The General Office.

This construction dispenses with the usual slate base. The firm, of course, builds motor-starting panels and pillars of the water-tight and gas-tight patterns, particularly for mining work.

In the smaller type of fuseboard for lighting work, the new "Home Office" pattern of fuse—in which the usual method of construction is reversed, the live parts being fixed at the back of the china bases instead of in front, so that the fuses make contact through slots in the china—is interesting.

In fuseboards of this kind the bases can be fixed on hinged battens, thus enabling wiring at the back to be got at easily without interfering with the board. We understand that several thousand fuseboards with "Home Office" fuses are on order from these works at the present time.

However, the speciality of the firm is probably the "honeycomb" fuse, which is constructed in stock sizes between 20 and 650 amperes capacity, and largely employed in the various fuseboards built in the works.

Many of our readers are, no doubt, familiar with its construction, which includes a peculiarly wired hollow cellular china body enclosed in a lined fibre carrier, and so arranged that when the fuse blows, the volatilised metal is deflected by end baffle plates into the interior of the china body and there condensed. Another feature is the wiring of the china interior by means of small through copper strands—which normally carry the bulk of the current—in conjunction with a central fusible tin band coupled by copper strands to the terminals; a double path is thus provided for the current so long as the full normal capacity of the fuse is not exceeded. Any increase of current beyond this raises the temperature of the fuse carrier and melts out the tin band; all the current then passes by way of the through strands which immediately blow.

Although such a fuse has a very heavy overload capacity for a short period, the fusible band controls the overload definitely and it is possible to supply the fuse under a guarantee as to performance.

Many tests have proved that this fuse will stand the heaviest short-circuit without damage to the terminals; indeed, the firm can point with pride to a collection of undamaged fuse sections which have withstood most unmerciful treatment in the endeavour to gain reliable information as to their probable behaviour.

Although we have not mentioned specifically the numerous patterns of Ajax ironclad switches and switch fuses, these are standard lines with the firm with which our readers are well acquainted.

The Finished Stores.

The General Machine Shop.

Standardisation and organisation have enabled the firm to successfully carry through some very large orders—exhaustive stocks of regular pattern switches and fuses being always available for despatch the same day as ordered.

In conclusion, we are indebted to Mr. Vernon Hope for an instructive visit and an interesting, if unintentional, demonstration of the success which attends originality of design and specialisation.

Machine and Fitting Shop for Small Ironclad Switchwork.

CRANE PLANT OF AN ITALIAN STEEL WORKS.

By Dr. Alfred Gradenwitz.

Recent extensions of the iron and steel works of Terni (Rome) entailed the installation of a number of cranes

destined for the most diverse purposes. After a very lively competition, in which the foremost crane builders of the chief industrial countries took part, the Maschinenfabrik Oerlikon, of Oerlikon, near Zurich, was entrusted with the construction of the crane plant. As this is one of the most remarkable installations of its kind in existence, a short description of the more important cranes will be of interest.

All the motors used in connection with this plant are fed from the three-phase current system of the works, at 42 cycles, 310 volts, and are designed as enclosed slip-ring motors, only the servo-motors for operating the brakes being enclosed motors with squirrel-cage rotors.

1. *Travelling Foundry Crane of 120 + 25 Tons' Capacity.*—The extensive foundries of Terni, where the heaviest castings are made, necessitated the installation of a travelling crane of 120 tons capacity, which was tested with a load of 150 tons on delivery.

Fig. 2 shows the crane with its ladle (which with its contents is 120 tons in weight). The main crab is designed to lift 120 tons, while an auxiliary crab with two motors serves for the lifting of loads up to 25 tons in weight, and is mainly used for tipping the ladle suspended from the main crab. The span between centres of crane rails is 18·25 m., and the lift of main hoist about 12 m. The auxiliary hoist has a lift of 17 m.

The main hoist lifts 120 tons at a speed of 1 m. per minute, and 60 tons at 2 m. per minute; the travelling speed of the crane at full load is 20 m. per minute, and of the main trolley 12 m. per minute. The lifting speed of the auxiliary trolley (fig. 4) at full load is 3 m. per minute, and at half load 6 m. per minute.

The crane consists of two stout box girders with parallel chords and substantial cross bracings. A gallery is arranged along one side, and the driver's cage is at one end of the bridge. The girders carry two rails for the main crab and two for the auxiliary crab, and two balancers fitted into the cross girders receive the axles of the travelling wheels.

The crane travels longitudinally on eight cast-steel wheels with steel axles, four of which are fitted with toothed rims for the drive. The longitudinal shaft, which is driven in the centre, carries two steel pinions, and is supported at several places by bearings. The main trolley carries two motors for lifting and traversing respectively. The lifting motor is direct-coupled by means of clutches with two worm gears running in oil in a casing, the axial thrust being taken by ball bearings. Pinions on the two worm-wheel shafts engage with the toothed rims of four cable drums, 680 mm. in diameter. The traversing motor of the trolley similarly communicates through a clutch with a worm-gear driving the shafts of the trolley rollers. The eight rollers, 500 mm. in diameter, are made of cast-steel and run on steel axles, four of them being fitted with toothed rims for the drive. Both motors can also be rotated by hand.

For holding the load there are provided two toggle-joint brakes automatically actuated by servo-motors, and there are also auxiliary safety brakes acting directly on the cable drums. This arrangement comprises four friction brakes for the four drums, each provided with a pinion and designed to be actuated from the driver's cage in case of emergency, by a pawl and ratchet wheel. All toothed

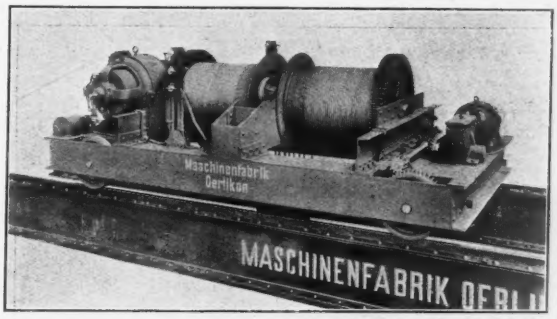


Fig. 4.—Auxiliary Trolley of Foundry Crane.

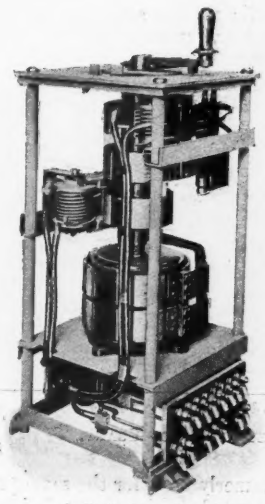


Fig. 1.—Reversing Starter of 120-ton Crane.

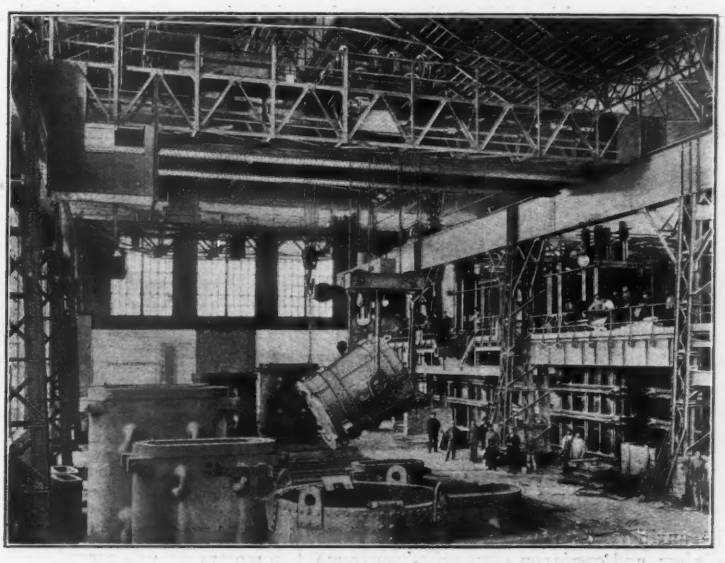


Fig. 2.—Foundry Crane of 120 Tons' + 25 Tons' Capacity.

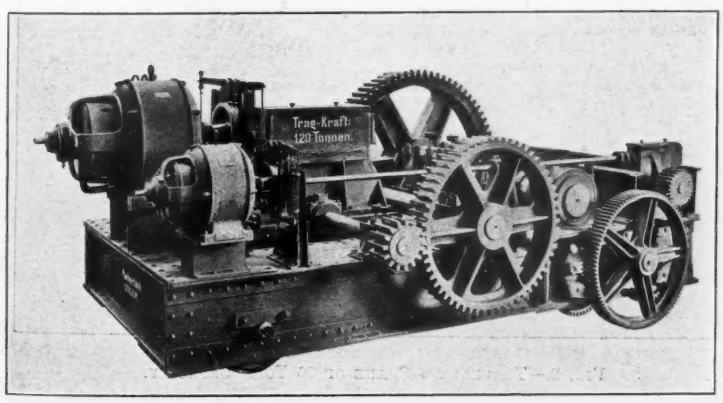


Fig. 3.—Trolley of 120-ton Gantry Crane (see next page).

wheels have been milled on special machines. An especially flexible high-grade plough-steel wire was used for the load cable, which is 20 mm. in diameter and about 340 m. in total length. This carries in a 4 × 6-fold suspension from a pulley block comprising eight pulleys, a substantial iron beam fitted at the ends with two jointed hooks for receiving the ladle, and in the middle with a double hook resting on ball-bearings for a load of 120 tons.

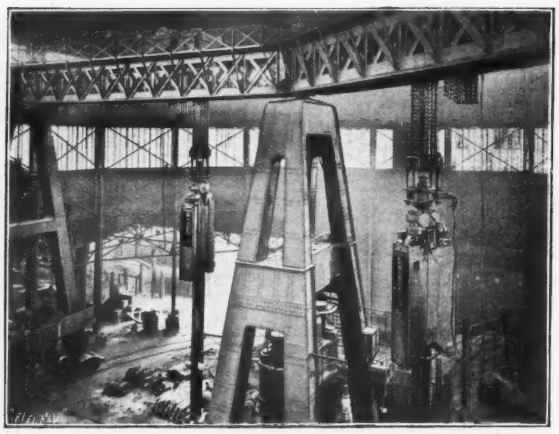


Fig. 5.—Twin Gantry Crane of 120 Tons' Capacity.

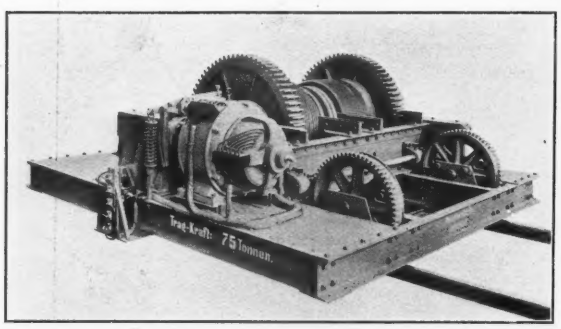


Fig. 6.—Trolley of 75-Ton Travelling Crane.

The auxiliary crab travels on rails arranged inside the box girders, and carries on a wrought-iron frame, two motors for traversing and for the lifting of loads up to 25 tons respectively, which can also be operated through a hand-crank, the energy being likewise transmitted to two worm gears connected by clutches. A toggle-joint brake and servo-motor are provided for stopping the load. The shaft of the worm-wheel carries two pinions engaging with the cast-steel toothed rims of the two cast-iron cable drums. The steel cable is 14 mm. in diameter and 210 m. in length, and is guided by four pulleys; it carries a simple wrought-iron crane hook on ball-bearings.

The traversing motion of the auxiliary trolley on four rollers is effected from the motor through worm gearing and a pair of bevel wheels, two of the rollers being fitted with toothed rims for the drive.

Both trolleys derive their current from 10 trolley contacts fixed by insulators on brackets, from the conductors running alongside of the crane girder.

The lifting motor of the main trolley, which is designed for lifting loads of 120 tons at a speed of 1 m. and 60 tons at a speed of 2 m., is wound for two different numbers of poles, viz., 8 poles for 120 tons and 4 poles for 60 tons, its output being 45 H.P. The traversing motor has at full load, with a speed of 12 m. per minute, at 1,200 R.P.M., an output of 18 H.P.

The lifting motor of the auxiliary hoist is designed for an output of 26 H.P. (for the lifting of loads of 25 or 12·5 tons at a speed of 3 or 6 m. respectively per minute) as a two-speed motor with the same numbers of poles and revs. per min. as the main motor, and the traversing motor has an output of 4 H.P. for a load of 25 tons at 20 m. per minute.

The motor effecting the longitudinal motion of the crane is—like all the rest—connected through a semi-elastic clutch with a worm gear transmitting the energy to the longitudinal shaft, and is fitted with a mechanical brake operated by a pedal from the driver's cage. Its output in transporting the crane at full load at a speed of 20 m. per minute is 40 H.P. This motor can also be driven by a hand crank.

All the motors are controlled from the driver's cage through a combined starter, comprising an electrically braked reversing starter for the main hoisting motor, a reversing starter with starting resistances and fuses for the motor effecting the longitudinal motion of the crane, and a similar one for the traversing motor. The auxiliary trolley is controlled through a reversing starter with starting resistance and fuses for the hoisting motor, and the same for the traversing motor of the winch.

2. *Gantry Cranes of 120 tons' Capacity with Turning Gears, for the Operation of an Hydraulic Press.*—In manufacturing heavy armour plates and guns for the Navy and for other purposes, the Terni Iron and Steel Works frequently use huge hydraulic presses, *e.g.*, a press of 4,500 tons' pressure, allowing the heaviest castings to be forged.

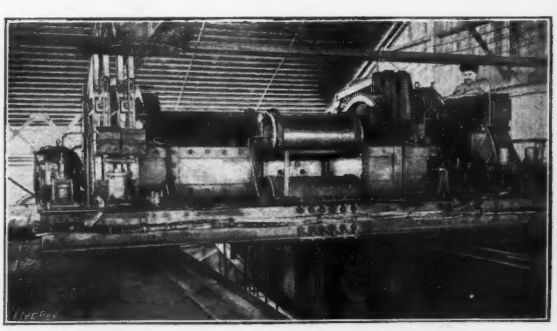


Fig. 7.—Trolley of 60-Ton Crane.

The pneumatic hammer formerly used for the same purpose was served by two hand-operated gantry cranes designed as a rotating twin gantry crane with common central pillar, which, on account of its wide range (about 22 m.), allowed the ingots to be taken from the furnace directly to the press without unloading. These cranes have now been reinforced, raising their capacity to 120 tons and converting from hand to electrical operation. The main data of this twin crane (fig. 5) are as follows:—Normal capacity (useful load)

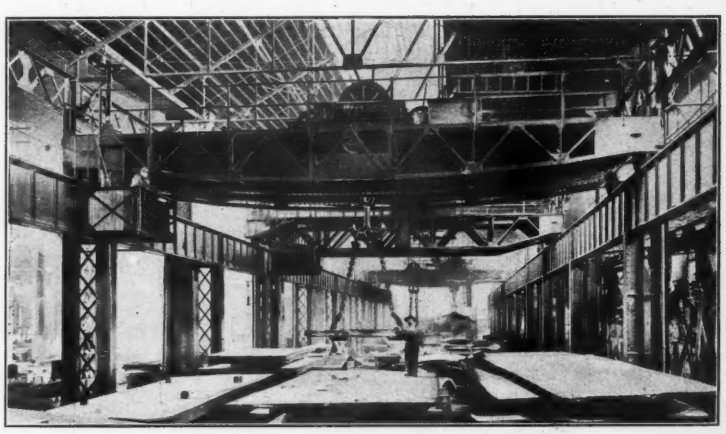


Fig. 8.—Travelling Crane of 75 Tons' Capacity.

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120 tons; gauges of trolleys, 1·625 m. and 1·995 m.; radius of crane track, 21·6 m.; lifting speed with load of 120 tons, 3 m. per minute; traversing speed of trolley with 120 tons, 20 m. per minute; speed of rotation of gantry as measured on the crane track, 15 or 30 m. per minute (the lower speed being used during pressing); minimum distance between press and axis of load suspension, 1,400 mm.

The electrical arrangements of both cranes are identical. The design of the motors and gear generally corresponds with that of the foundry crane. Two of the four rollers of the trolley have toothed rims for the drive, and a Gall chain, the length of which has been so designed that the turning gear suspended by it may touch the ground in an erect position, serves to carry the load (fig. 5). This has been designed as a 2 × 4-fold chain. An alarm bell is sounded as soon as the terminal positions are reached.

The main current supply to each crane is in the pivot above the presses, and is designed with slip-ring contacts. Current supply to the trolleys and to the motor of the turning gear is effected by means of 16 insulated roller contacts fixed to a bracket. The output of the lifting motor is 135 H.P. at 1,220 R.P.M., and that of the traversing motor 25 H.P., at the same speed. The drive for the rotation of each crane comprises a two-speed motor of 65 H.P. at 810 R.P.M., or 35 H.P. at 410 R.P.M., with 6 or 12 poles respectively.

In order to allow heavy and clumsy castings to be dealt with as easily and simply as possible, turning gears suspended by the crane chain are used for turning the ingots round below the press. Each of these turning gears is an iron structure 2·3 m. in width, with lateral sheet metal walls and a bracket for receiving the motor and drive. It is suspended from the Gall chain by means of a beam with ball bearing and rollers, and is free to rotate round its vertical axis. The driving motor is designed to yield 35 H.P. during 4-5 hours' continuous operation.

The piece suspended by this turning gear is turned round at will below the press, in accordance with the requirements of the service. The motor is connected with a worm gear by a friction clutch ensuring a smooth operation. The turning gear is controlled from the driver's cage of the gantry crane, its speed of motion being regulated in three to four steps by inserting resistances. By regulating the speed of motor, ingots of different sizes can be turned round at practically the same peripheral speed.

The service of the turning gear requires considerable skill and foresight on the part of the crane driver, who with one hand controls the lifting and lowering, and with the other the turning-gear motor. In view of the rapid working of the press, a continuous regulation of the crane starters is required, the load being lifted quickly after each pressing operation and turned round by the turning gear. The resulting fluctuations in the load on the motors had to be allowed for in the design of them.

The several motors for lifting, traversing and turning respectively, can be controlled by means of two independent sets of starters. This double control allows the pressing process to be watched more easily by the driver.

3. *Travelling Crane of 75 tons' capacity for the Operation of the Armour-plate Rolling Mill and Hydraulic Moulding Presses.*—The main data of this crane are as follows:—

Span between centres of crane rails, 13·43 metres; height from floor to upper edge of crane rails, 7·9 metres; capacity, 75 tons, with lifting speed of 1·80 m. per minute; 37·5 tons with lifting speed of 3·60 m. per minute; traversing speed, with full load, 12 m. per minute; travelling speed, with full load, 25 m. per minute.

The equipment of the crane corresponds to that of the foundry crane described above, apart from the auxiliary trolley used in connection with the latter. Three motors are provided for the various motions, the lifting motor of 40 H.P. being designed with eight and four poles in accordance with the two lifting speeds of 1·8 and 3·6 metres per minute, with loads of 75 and 37·5 tons (at 600 and 1,200 R.P.M. respectively). A pole switch operated by remote control from the driver's cage is provided for changing from one speed to the other. The traversing motor has an output of 10 H.P. at 1,200 R.P.M., and the motor for the longitudinal motion of the crane (which is coupled by a semi-elastic clutch to toothed gearing), 25 H.P. at 1,200 R.P.M.

The brake of the lifting motor is controlled automatically by a servo-motor. The lifting hook is a wrought-steel double hook resting on ball bearings and suspended by 2 × 6 steel cables, each 23 mm. in diameter (figs. 6 and 8).

4. *Travelling Cranes of 60 and 20 tons' capacity respectively for the gun-hardening factory.*—Two special cranes built by the Oerlikon Machine Works are used to immerse gun barrels, vertically suspended from the hook, in oil tanks for hardening; they suffice for the longest tubes manufactured at Terni, and are especially remarkable for their considerable lowering speed, which is accurately adjusted.

In accordance with their special use, these cranes had to be mounted at a considerable height above the floor. The cranes are installed in two adjoining shops at different levels, the 60-ton crane being situated at 22 m. and the 20-ton crane at 11·4 m. from the upper edge of the crane rails to the ground. Both cranes are of the same design as those already described, their main data being as follows (fig. 7):—

	60-ton crane.	*20-ton crane.*
Lifting speed with full load ...	6 m. per min.	8 m. per min.
Lowering speed with full load	80 „ „	80 „ „
Traversing speed	20 „ „	20 „ „
Travelling speed	50-25 „ „	60-30 „ „

The lifting motors are fitted with a pneumatic brake on the Jordan system, which being operated from the driver's cage through electric remote control allows the lowering speed to be kept constant.

The brake is designed as a jaw brake, being put on by a weight and relieved by the piston of a brake cylinder fed with compressed air. A small air pump driven from the lifting motor produces compressed air, which is accumulated in a special tank, whence it is supplied in accordance with requirements to the brake cylinder. On a given air compression being reached, the air supply is cut off automatically by a pressure regulator, the compressor running at no load until the pressure falls again. A regulator permanently coupled to the lifting drum adjusts the air pressure in the brake cylinder, so that the lowering speed remains constant with any load (as well as at no load). During the lowering operation the lifting motor is uncoupled by a claw clutch actuated by compressed air, and the hook and load can then be lowered at 13 times the lifting speed (80 m.) without carrying the motor along. The control of the lowering motion is so arranged that lowering cannot be effected before uncoupling the motor. On account of the considerable power (about 1,000 H.P.) absorbed by the brake in lowering, the mechanism is designed most substantially. In order to eliminate any risk of failure of the brake during the hardening process, which would be liable to have the most disastrous consequences, four brake disks are provided on the 60-ton crane and two brake disks on the 20-ton crane, each of which alone is able to keep the load suspended.

Enormous difficulties, which could not be foreseen, were met with in designing this braking arrangement to comply with the special conditions to be met by the special cranes and to ensure a smooth operation; the braking effect is absolutely reliable and the lowering speed is kept constant, while all shocks and jerks are avoided and braking distances reduced to a minimum.

For traversing, there is provided a toggle-joint brake operated automatically by a servo-motor. The wrought-steel double hook is free to rotate on ball bearings round its vertical axis. It is suspended in the 60-ton crane by a 12-strand cable and in the 20-ton crane by an eight-strand cable.

The motor outputs are as follows:—

	60-ton crane.	*20-ton crane.*
Lifting motor with full load ...	110 H.P.	50 H.P.
Traversing motor with full load ...	15 H.P.	6 H.P.
Travelling motor with full load ...	36 H.P.	20 H.P.

All these motors run at a speed of 1,200 R.P.M.

The arrangement of the trolley contacts is the same as in connection with the other cranes, 13 bare copper conductors, 6 and 9 mm. in diameter respectively, with insulators and tightening screws, being used to convey the current to the trolley motors.

In addition to the cranes above described, a number of transporting cranes of the most diverse capacities and of the Maschinenfabrik Oerlikon's standard design have been supplied to the various workshops of the extensive Terni Iron and Steel Works.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Central Station Officials.—At the meeting on the 13th inst., of the Ealing B.C., the Mayor said he desired publicly to thank MR. J. D. KNIGHT, borough electrical engineer, and MR. A. E. PULLEN, for having very kindly acted as stokers at the electric light works on a recent evening when the employés were being entertained at the Town Hall. It only showed, said his Worship, how ready the head officials were to do anything to enable those under them to have an evening's enjoyment.

MR. G. A. BRUCE, electrical engineer and tramways general manager to the Lowestoft T.C., has tendered his resignation.

With reference to the paragraph inserted in our issue of February 7th with regard to the decision of the Electricity Committee of Poplar to give prominence to the managerial side of the department, the Committee has now reconsidered its decision as regards the salaries of MR. V. H. CRUICKSHANK, station engineer, and MR. E. R. INGRAM, mains engineer, and these gentlemen are now to receive salaries of £225 per annum, rising by annual increments of £12 10s. to £300 per annum.

The Installation Engineer of the Tynemouth undertaking has handed in his resignation, which has been accepted by the Electricity Committee, who invite applications for filling the vacancy on the same terms and remuneration as at present.

The salary of the electrical engineer at Rhyl was increased, at a meeting of the Rhyl District Council last week, from £170 to £200 per annum.

Tramway Officials.—The Bournemouth T.C. has, on the recommendation of the Tramways Committee, decided to increase the salary of MR. VICKERS, chief assistant and electrical engineer, from £325 to £375 per annum, with annual increments of £25 to a maximum of £450; that of MR. BALDWIN, tramway traffic superintendent, by £25 a year; and that of Mr. HARTLEY, works superintendent, by £25 per annum.

Out of some 300 applicants, MR. G. M. BARRELL, chief cashier of the Leeds Tramway Department, has been appointed to a similar position under the Huddersfield Tramways.

General.—MR. SIDNEY ANDREWS has severed his connection with Messrs. Veritys, Ltd., for whom he acted as manager for Scotland for many years, and is now representative for Scotland and Ireland for Messrs. Royce, Ltd., of Manchester. His address is 133, Mount Annan Drive, Mount Florida, Glasgow, and all communications should be sent there.

MR. HENRY C. CREWS, M.I.E.E., of Manchester, has been appointed by the governing body of Denstone College to act as consulting electrical engineer in charge of the electrical installation at the college.

On the occasion of their golden wedding, MR. and MRS. COX-WALKER have been presented by the present and past employés of Messrs. Cox-Walkers, Ltd., electrical engineers, of Darlington, of which Mr. Cox-Walker is a governing director, with a silver hot-water jug.

MR. COLIN P. SUTTHERY, of the staff of the British Thomson-Houston Co., Ltd., of Rugby, who is leaving to take charge of the electrical business of Messrs. Johnson & Fletcher, at Bulawayo, Rhodesia, has been presented by his colleagues with an attaché case.

We are informed that the old-established firm of Clark, Forde and Taylor (H. A. Taylor, A. L. Dearlove and R. M. Sayers), consulting engineers to the Pacific Cable Board and many of the large submarine cable companies, has been joined as partner by Dr. J. Erskine-Murray, D.Sc., F.R.S.E., the well-known expert in wireless telegraphy. The style of the firm after March 25th will be Clark, Forde, Taylor & Erskine-Murray, 4, Great Winchester Street, E.C. By this combination the firm will be in a position to advise upon, and act as consultants in, all branches of telegraphic engineering. The firm has been going for over 40 years, and at one time or another has acted as engineers for nearly all the large cable companies, supervising the making and laying of over 175,000 nautical miles of submarine cable. It must not be supposed that the firm fears the effect of wireless on cable work; it is associating the two systems in the belief that they will be helpful to each other, and that their interests do not really clash. Mr. Herbert Taylor will not now take such an active part in the firm as heretofore, but his valuable experience and advice will be available.

Obituary.—We regret to record that the death occurred suddenly at Aberdeen on 15th inst., of MR. WILLIAM BULLOUGH, of Messrs. Howard & Bullough, Accrington, in his 50th year.

NEW COMPANIES REGISTERED.

Cunningham, Ltd. (127,664).—This company was registered on March 10th, with a capital of £1,500 in £1 shares, to take over the business of an electrician and electrical engineer carried on by R. N. Cunningham, at [illegible] ware Road, and 8, Wellington Terrace, Bayswater Road, W., as "R. N. Cunningham & Co." The subscribers (with one share each) are:—R. N. Cunningham, 171, Edgware Road, W., electrical engineer; L. Isaacs, 63, Albion Road, Newington Green, N., traveller. Private company. The first directors are R. N. Cunningham (permanent governing director), R. L. Isaacs. Registered office, 171, Edgware Road, W.

British Electric Heater Co., Ltd. (8,571).—Registered March 7th, by Dalgleish, Debbie & Co., 26, Charlotte Square, Edinburgh. Capital £50,000 in £1 shares (30,000 participating pref.). Objects: To carry on business as electricians, mechanical, hydraulic and general engineers. The signatories (with one share each) are:—T. H. McLaren, 105, West George Street, Glasgow, clerk; M. Blair, jun., Garthland, Hamilton, clerk; K. Patrick, Trafford Bank, Bishopbriggs, clerk; J. B. Dunlop, 181, Dobbie Street, Glasgow, clerk; J. McGavin, Cambuskeith, Kilmarnock, clerk; H. J. Stevenson, 160, Onslow Drive, Dennistoun, Glasgow; Miss I. W. Armstrong, 66, Ardwall Terrace, Rutherglen. The first directors (to number not less than four or more than nine) are A. W. Terrance, A. Green-Thompson, G. Ritchie, R. W. Hogarth, C. H. Urmsten, and G. R. Young; qualification, 100 shares; remuneration, £50 per annum (£50 extra for chairman). Registered office, 105, West George Street, Glasgow.

C. A. Parsons & Co., Ltd. (137,619).—Registered March 7th, by Crossman, Prichard, Crossman & Block, 16, Theobald's Road, W.C. Capital, £450,000 in £100 shares. Objects, to carry on the business of electrical, hydraulic, mechanical and general engineers, founders and workers in metals, boiler makers, machinery and implement manufacturers and designers, shipowners, &c., to acquire the businesses and undertakings of C. A. Parsons and Co., of the Heaton Works, Newcastle-on-Tyne, and elsewhere (including as part thereof the business carried on by Scott & Mountain, Ltd., at the Close Works, Gateshead), and to adopt an agreement with the Hon. Sir Charles A. Parsons. The signatories (with one share each) are:—Hon. Sir Charles A. Parsons, K.C.B., Heaton Works, Newcastle-on-Tyne; A. G. Parsons, Heaton Works, Newcastle-on-Tyne, engineer; W. H. Johnston, Heaton Works, Newcastle-on-Tyne, engineer. Private company. The first directors (to be not less than three or more than seven, are Hon. Sir Charles A. Parsons, K.C.B., and not more than six others, to be nominated by him; qualification, £1,000; remuneration as fixed by the company. Solicitor, T. W. Thompson, Newcastle-on-Tyne. Registered office, Heaton Works, Heaton, Newcastle-on-Tyne.

J. W. Courtenay, Ltd. (137,549).—Registered March 4th, by G. D. Perks, 36, New Broad Street, E.C. Capital, £50,000 in £1 shares (10,000 6 per cent. cumulative preference, and 40,000 ordinary). Objects: To carry on the business of advertising agents and contractors, billposters, manufacturers of and directors in advertising specialities, electrical and mechanical signs and apparatus, printers, lithographers, designers, publishers, booksellers, &c., and to adopt an agreement with J. W. Courtenay, of 12, Norfolk Street, W.C. The signatories (with one share each) are:—J. T. Chapple, 79, Gresham Street, E.C., solicitor: W. W. Wright, 33-4, Broad Street Avenue, E.C., chartered accountant. Private company. The first directors are J. W. Courtenay, W. W. Wright and J. T. Chapple; remuneration (except managing director) £100 each per annum.

Spiral Regulating Dynamo Co., Ltd. (127,532).—This company was registered on March 3rd, with a capital of £5,000 in £1 shares, to acquire from A. A. Price patent rights relating to an electric dynamo. The subscribers (with one share each) are:—J. H. Turner, The Elms, Willesden Green, N.W., contractor; F. T. W. Price, 122, Aldersgate Street, E.C., merchant; A. A. Price, 25, Charlotte Street, W., engineer. Private company. The number of directors is not to be less than three or more than five: the first are J. H. Turner, F. T. W. Price and A. A. Price; qualification, £100; remuneration according to profits. Registered office, 25, Charlotte Street, W.

Rotary Units, Ltd. (127,656).—This company was registered on March 5th, with a capital of £600 in £1 shares, to carry on the business of founders, engineers, makers of steam, gas and oil engines, petrol and other motors, motor-cars and 'buses, motor-boats, gas-producer plants, boilers, steam and water turbines and air compressors, electricians, manufacturers of electrical apparatus, &c. The subscribers (with one share each) are:—C. W. Jamieson, 2, Sunningdale Gardens, W., engineer; A. G. Grice, Drumgeith, Dundee, engineer; J. T. Wood, Home Works, Datchet, engineer; C. M. Keiller, Home Works, Datchet, engineer. Private company. Table "A" mainly applies. Registered by Jordan & Sons, Ltd., 116-117, Chancery Lane, W.C.

Rodonit Syndicate, Ltd. (127,527).—This company was registered on March 3rd, with a capital of £5,000 in £1 shares, to take over the business of manufacturers of "Rodonit," carried on by W. Hermann and F. D. Bull, at Southbury Road, Enfield, as Hermann, Bull & Co. The subscribers (with one share each) are:—F. D. Bull, merchant, 14b, Manor Road, Stoke Newington, N.; R. Atherstone, 30, Springfield Avenue, Muswell Hill, N., electrical engineer. Private company. The first directors are W. Hermann, Hereward House, Enfield, F. D. Bull, R. Atherstone and C. W. Beckmann. Secretary, C. W. Beckmann. Registered office, 20, Victor Road, Finsbury Park, N.

Anger Manufacturing and Supply Co., Ltd. (127,703).—This company was registered on March 12th, with a capital of £2,000 in £1 shares, to acquire from J. E. Anger and G. H. Anger the invention of an automatic brake adjuster, and of improvements in apparatus for automatically adjusting or taking up the slack in brakes of tramcars and other vehicles, together with the business of engineers carried on by them. The subscribers (with one share each) are:—G. H. Anger, 186, Strand Road, Preston, engineer; A. Foster, 10, St. George's Square, St. Anne's-on-Sea, cotton spinner and manufacturer; J. Wilson, 52, Higher Bank Road, Fulwood, Preston, rubber merchant. Private company. The number of directors is not to be less than three or more than five; the first are G. H. Anger (managing director), A. Foster and J. Wilson (all permanent, subject to holding 100 shares); qualification of ordinary directors one share; remuneration of managing director, £260 per annum. Solicitors, W. R. & W. Ascroft, Preston. Registered by Jordan & Sons, Ltd., 116-117, Chancery Lane, W.C.

Parana Power Syndicate, Ltd. (127,747).—This company was registered on March 13th, with a capital of £10,000 in £1 shares, to acquire shares, debentures and securities of tramway, light and power companies in Brazil or elsewhere, and to adopt an agent with A. J. Byington. The subscribers (with one share each) are: W. J. Simpson, 35, Kings Road, Willesden Green, N.W., clerk; J. M. Tolley, 2, Bond Court, Walbrook, E.C., clerk. Private company. The number of directors is not to be less than two: the first are W. J. Simpson and J. M. Tolley. Registered office, 4, London Wall Buildings, E.C.

New British Ever-Ready Co., Ltd. (187,638).—Registered March 7th by Corbould, Ellis and Mitchell, 14, Clement's Lane, Lombard Street, E.C. Capital £200,000 in £1 shares (115,000 ordinary and 85,000 7 per cent. cum. participating preference). Objects: To carry on the business of electricians, electrical engineers, manufacturers of and dealers in electrical appliances, wires, accumulators, batteries, dynamos, lamps, switches, torches, novelties and specialities, mechanical engineers, producers and suppliers of electricity and power, and to take over the business of the British Ever-Ready Electrical Co., Ltd. Power is also taken to manufacture and deal in motor vehicles, flying machines and the like. The signatories (with one share each) are:—S. Stern, Ever-Ready Works, Hercules Place, Holloway, N., merchant; G. F. Ritzelberger, Hercules Place, Holloway, N., works manager; M. Goodfellow, Hercules Place, Holloway, N., company secretary; C. H. Dade, 1, Kingsway, W.C., manager of public company; B. R. H. Baker, Craigenan, Blanchford Road, Stamford Brook, W., accountant; E. McNair, 3, East Ham Road, Littlehampton, secretary of public company; G. Bostock, 21, Ironmonger Lane, E.C., chartered accountant. Minimum cash subscription, 85,000 preference shares. The first directors, to be not less than three or more than five, are S. Stern, G. F. Ritzelberger, M. Goodfellow, C. R. C. Noller (76, Coleman Street, E.C.) and C. H. Dade (Electrical Federation Offices, 1, Kingsway, W.C.); qualification, £250 preference shares; remuneration not more than £100 each per annum (managing director, £750 per annum), with any extra sums voted by the company. Registered offices, Hercules Place, Holloway, N.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Sun Electrical Co., Ltd. (63,261).—Capital, £45,400, in £1 shares (20,000 pref.). Return dated January 6th, 1913. 5,400 ord. and 13,764 pref. shares taken up. £19,164 paid. Mortgages and charges: £8,875.

Melbourne Electric Supply Co., Ltd.—A memorandum of satisfaction in full on March 5th, 1913, of mortgage dated August 3rd, 1911, securing not more than £250,000, has been filed.

Chippenham Electric Supply Co., Ltd.—Particulars of £2,000 debentures created February 3rd, 1913, and secured by trust deed of even date, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the whole amount being now issued. Property charged: The company's undertaking and property, present and future, including uncalled capital and part of the old gasworks, Chippenham, with fixtures, plant and machinery, &c., thereon. Trustees: A. Cotes and A. A. Douglas.

Tyer & Co., Ltd.—Particulars of £7,000 debentures, created February 27th, 1913, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the whole amount being now issued. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees.

Sun Electrical Co., Ltd.—A memorandum of satisfaction to the extent of £275 on March 5th, 1913, of debenture stock dated March 31st, 1911, securing £7,000, has been filed.

City of Ely Electric Light and Power Co., Ltd. (79,285).—Capital, £5,000 in £1 shares. Return dated January 7th, 1913; 3,003 shares taken up; 2s. per share called up; £300 6s. paid. Mortgages and charges: Nil.

Electrical Industries Development Co., Ltd. (89,461).—Capital, £25,000 in £1 shares (20,000 pref.); return dated January 13th, 1913; 9,007 pref. and 5,000 ord. shares taken up; £1 per share called up on 4,007 pref.; £4,007 paid; £10,000 considered as paid on 5,000 pref. and 5,000 ord. Mortgages and charges: Nil.

India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd. (1,122 C).—Capital, £812,000 in £10 shares (50,000 ord., 25,000 pref., and 6,200 unissued); return dated December 31st, 1912 (filed February 10th, 1913); 50,000 ord. and 25,000 pref. shares taken up; £750,000 paid. Mortgages and charges: £400,000.

"Dac" Accumulator Syndicate, Ltd. (40,763).—Capital, £25,000 in £1 shares. Return dated January 14th, 1913. 19,486 shares taken up. £1 per share called up on 4,486. £4,461 paid, leaving £25 in arrears. £15,000 considered as paid on the remainder. Mortgages and charges: Nil.

Cutting Bros., Ltd. (81,178).—Capital, £6,000 in £10 shares. Return dated January 4th, 1913. 500 shares taken up. £10 per share called up on 100 shares. £1,000 paid. £3,200 [illegible] per share) considered as paid on 400 shares. Mortgages and charges: £4,00[illegible].

Supplies Construction Co., Ltd. (66,081).—Return dated December 31st, 1912. Capital, £350,000 in £5 shares. All shares taken up. £350,000 paid. Mortgages and charges: Nil.

CITY NOTES.

Madras Electric Tramways (1904), Ltd.

THE directors' report for 1912 states that there was a gross profit of £20,032. After debiting interest and London office expenses, making provision for the debenture stock sinking fund, and transferring £5,000 to the depreciation and renewal fund, there remained a balance of £9,419, plus £1,104 brought forward, making £10,523. Out of this £3,450 was devoted to a dividend of 6 per cent. per annum on the old preference shares; £551 to a dividend of 6 per cent. per annum on the new preference shares; a dividend of 4 per cent. per annum on the ordinary shares is to be paid, absorbing £2,290; and there is devoted to writing off from the cost of issue of new preference shares £500, leaving to be carried forward £3,732. The traffic receipts show an increase of 11·98 per cent. upon the 1911 figures. The undertaking has been maintained, as heretofore, out of revenue, and special improvements and renewals have been debited to the depreciation and renewal fund, as formerly. The reserve arising from the debenture stock sinking fund now amounts to £4,608. During the year 5,860 6 per cent. cumulative preference shares were issued to repay the temporary loans obtained for the extensions to Washermanpet and Royapuram, which were opened in March and September respectively. Four new large double bogie cars have been supplied, and six trailers are being provided for the increased traffic. Further extensions of the tramway are also contemplated. The board record the death of their chairman, Mr. W. S. B. McLaren, M.P. They have elected Mr. Arthur Maxwell Quill as his successor.

The annual meeting was held on March 13th at the offices, Dashwood House, E.C., Mr. A. M. Quill presiding.

The CHAIRMAN, in proposing the adoption of the above report, said it was a great pleasure to him, on the first occasion of his chairmanship, to be able to present accounts which again showed a satisfactory improvement. The traffic receipts amounted to Rs. 598,092, being an increase of 11·98 per cent., and the number of passengers carried was 15,895,245—an increase of 8·45 per cent. Part of that increase was due to the opening of two short extensions in March and September respectively, but, obviously, some time must elapse before the full benefit of those extensions could be received. The greater part of the improvement, therefore, was obtained from the old lines, which was very gratifying, considering that the traffic had shown a steady upward tendency since the fares were reduced some years ago. Their fares were probably lower than on any other tramway in the world, but as they had to depend almost entirely upon the native population, they were compelled to adopt low fares. The percentage of working expenses to receipts was less than on most tramways, proving that the undertaking was efficiently and economically managed. Under existing conditions, they could hardly look for any further marked development from the existing lines. The blot on the system was a mile of single track, which passed through very narrow streets, where a double track was impossible. That caused great congestion at times, but they could not increase the number of the cars on the system. He told them at the last meeting that negotiations were proceeding for a diversion of the lines, but he was sorry to say that little real progress could yet be reported in that direction. They had offered to contribute a substantial amount towards the cost of widening two bridges which the diversion would entail, and they were urging upon the authorities the necessity of the diversion, if they were to properly fulfil their obligations to the travelling public. Further extensions of the undertaking were contemplated, but they could not be proceeded with until the diversions had been authorised. He trusted that before this time next year a solution of the difficulty would have been arrived at. The amount expended on renewals—£3,007—was less than they anticipated, but the two extensions absorbed the time of the staff to a great extent. The substitution of 90-lb. rails for 60-lb. would, he hoped, be practically completed before the end of 1914, and as the larger part of the replacement had been completed, they had fixed the contribution to the renewals fund for 1912 at £5,000. The balance at the credit of that fund at the end of the year was £7,645.

MR. JAMES GRAY seconded the motion, and the report was adopted.

MR. P. E. BEACHCROFT, in proposing a resolution fixing the remuneration of the directors at £200 a year each, as from January 1st, 1912, said that hitherto those gentlemen had not been at all adequately recompensed for the work they had done for the company. The board were to be congratulated upon the fact that the ordinary dividend this year was 4 per cent., as compared with 2 per cent. a year ago, and in view of the satisfactory progress the company had made, he thought it quite time that the directors were properly paid.

MR. W. BULLOCH seconded the resolution, which was carried unanimously.

The auditors and the retiring director having been re-elected, the proceedings terminated with a vote of thanks to the chairman.

New York Telephone Co.—The report states that the combined telephone earnings of the company and its associated companies for 1912 amounted to $65,632,689, showing an increase of $6,613,278 over 1911. The net telephone earnings, including $1,510,072 other income, were $18,681,070, an increase of $2,164,775. Interest charges absorbed $3,179,573 and dividends $10,009,335, leaving a balance to surplus and reserves of $5,492,162, an increase of $1,572,126. On December 31st last there were 985,780 stations in the system directly operated by the company and its local connecting companies, an increase of 97,445. Including the associated and connecting companies, there were in service in the whole system 1,756,343 stations, an increase of 232,319 stations.

Stock Exchange Notices.—Applications have been made to the Committee to appoint a special settling day in—

Sun Power Co. (Eastern Hemisphere), Ltd.—Further issue of 2,050 ordinary shares of £1 each fully paid, Nos. 168,508 to 170,557.

And to allow the following to be quoted in the Official List—

Vancouver Power Co., Ltd.—Further issue of £50,000 4½ per cent. perpetual guaranteed debenture stock.

Llanelly and District Electric Lighting and Traction Co., Ltd.—The directors' report states that the profit for 1912, including the balance brought forward, and after payment of loan and debenture interest charges, is £6,401. After paying the 6 per cent. preference interest there remains to be carried forward £2,801. The business, especially in the power and lighting departments, continues to expand, and the above results, which were obtained notwithstanding the coal strike and other abnormal causes seriously affecting the revenue, are regarded as entirely satisfactory.

O. C. Hawkes, Ltd.—The directors' report for 1912 shows a balance of £9,687, out of which 5 per cent. is paid on the preference shares, absorbing £4,250, and £4,000 is added to the reserve fund and £1,437 carried forward. The turnover has been progressive, and the profits would have paid a dividend, but it has been thought politic to place an increased amount to reserve bearing in mind that a further development of new branches is in view.

Tynemouth and District Electric Traction Co., Ltd.—The total revenue for the year 1912 was £13,661. After deducting all expenses chargeable to revenue, including a provision of £1,000 for renewals, and writing off a loss of £277 on sale of Consols, there remains a surplus of £4,377, plus £4,929 brought forward. The directors have placed £1,250 to reserve, and after paying a dividend of 5 per cent. on the cum. preference shares, a dividend of 4 per cent. is given to the ordinary shares, £297 being carried forward. Bad weather affected the receipts.

Liverpool District Lighting Co., Ltd.—The directors have declared a dividend at the rate of 4 per cent. per annum (less tax) for the last half of 1912.

Winnipeg Electric Railway Co.—The directors have declared a dividend at the rate of 3 per cent. for the quarter ending March 31st.

Durham Collieries Electric Power Co., Ltd.

A MEETING of the debenture-holders was held on Monday, at Winchester House, E.C., Mr. A. W. Tait presiding.

The CHAIRMAN said that the meeting was held in accordance with an order made by the Registrar, for the purpose of considering a scheme of arrangement proposed to be made between the company and the debenture-holders. The agreement, which had been entered into with the Newcastle company for the purchase of the undertaking and property of the company contained the following eight undertakings:—

1. 10,000 fully paid ordinary shares of £5 each of the Newcastle company are to be issued to the company's debenture-holders in proportion to their holdings, subject to the proviso that fractions of shares may be sold by the Receiver for the benefit of those entitled to them.

2. The surrender by the Newcastle Co. of £19,860 debentures in the company for the benefit of the holders of the remaining debentures.

3. The discharge by the Newcastle Co., with interest, of a loan to the company of £3,500, made by third parties, and the procuring of the surrender to the company for cancellation of £8,000 prior lien bonds (ranking in priority to the debentures) deposited as security therefor.

4. The release of the principal and interest due in respect of a further £4,000 of such prior lien bonds held by the Newcastle Co.

5. The surrender by the company for cancellation of a further £19,900 of such prior lien bonds, deposited with the Newcastle Co. as security for a debt of £12,437 10s. owing by the company, and the release of the debt.

6. The release by the Newcastle Co. of their claims to have further prior lien bonds allotted in respect of a debt of £8,900 for work done, on the express agreement that the same should be secured by a further deposit of prior lien bonds.

7. The payment by the Newcastle Co. of all the costs and expenses of the debenture-holders' action and of carrying the the agreement into effect.

8. The settlement of certain outstanding liabilities for trustees' fees, rent, office and other expenses.

Continuing, the CHAIRMAN said that if the agreement was passed by the meeting and sanctioned by the Court, the result to the debenture-holders would be that they would receive approximately £28 in fully-paid ordinary shares of the Newcastle company for every £100 debenture. That, of course, was a very disappointing outcome, and involved a very heavy loss to the debenture-holders, and the step had only been taken after the most careful consideration and the obtaining of expert advice. It was also put forward, with the concurrence and approval of the Committee of debenture-holders, which was appointed in 1908. They would probably remember that at that time owing to the poor results which had been shown and the financial difficulties of the company a rearrangement of its affairs was then carried out, which rearrangement was approved by the debenture-holders at a meeting held in December, 1908. Under the rearrangement the debenture-holders agreed to waive their foreclosure rights in respect of interest on their debentures for a period of five years to December 31st, 1913, on condition that any net profit earned by the company during that period, after meeting prior lien debenture interest, should be distributed among the debenture-holders. Only one distribution had been made, to the extent of 1½ per cent., on the debentures. An agreement was also entered into with the Newcastle-upon-Tyne Electric Supply Co., Ltd., and the County of Durham Electric Power Supply Co., under which the former company agreed to operate the company's generating station at Philadelphia, and to supply any current which might be required by its consumers at fixed prices, and also to manage the company's distribution system on a sliding scale according to the output; this arrangement to last for a period of 42 years from January 1st, 1909. At the time those arrangements were made the technical advisers of the company believed that with the growth of the company's business, profits would be earned which would gradually enable them in time to meet the debenture interest. As, however, those anticipations were not borne out in actual operation, the board decided to obtain independent expert advice on the position, and they accordingly requested Mr. W. A. Chamen to make a report. In this Mr. Chamen said that he had gone carefully through the consumers' agreements, and he regretted to say that he did not see any way in which the company could hope for any improvement in the price paid during the terms for which the agreements were to run, unless the consumers were willing to grant a revision of the price, which there did not seem to be much hope of their doing. Regarding the agreement with the Newcastle company as to operation, it was a somewhat complicated one. In it they protected themselves in the event of a rise in the price of coal, and the result had been that the company had suffered materially, and the recent trouble in the coal trade had not helped the situation. Under the terms of the agreement with the Newcastle company the prices could only be revised after 21 years by arbitration. There was no doubt that the estimates made by the technical experts at the time when the consumers' arrangements were made, and at the time the agreement of operation with the Newcastle company was entered into, had been seriously at fault. The only thing that could be said in this connection was that there was no experience available in this country at the time with regard to large loads for colliery requirements. The agreements with the consumers and with the Newcastle company were based on a probable load factor which had never been attained, and in fact they had fallen very far short of it. The present output of the company was at the rate of about 24,000,000 units per annum with a load factor of approximately 40 per cent., and, in the opinion of the expert, it would require an improvement in the load factor up to 70 per cent., with an output of 35 millions per annum, to enable the company to pay debenture interest, assuming the price of coal did not exceed 6s. per ton, and that no further money was required for the purpose of extending the supply. In the opinion of the expert, none of those assumptions were warrantable, and he stated that, unless some alteration could be made in the controlling agreements, the company must get into a worse and worse position as time went on. After the expert's opinion had been carefully considered, and after the directors had endeavoured to obtain concessions from the consumers and from the Newcastle company, without success, they approached the committee of debenture-holders with regard to the position, and acting under their advice, negotiations were entered into with a view to the sale of the company's undertaking. They would appreciate that this was a very difficult matter. The company was not an authorised undertaker under the Electric Lighting Acts, and the whole of its distribution system, with the exception of a small part, was under wayleave and other agreements. As to the company's power station, a large amount of the plant required for the supply to the consumers did not belong to the company, but was the property of the Newcastle company, and there was, therefore, only one possible buyer of the assets. The negotiations for sale took a very considerable time, and it was only after great difficulty that the present offer was finally adjusted. He could only recommend under the circumstances that the offer should be accepted. There was practically no alternative, and if the assets were sold at a break-up he did not believe that the debenture-holders would get anything. He concluded by proposing a resolution authorising the board to carry the scheme into effect.

MR. W. S. POOLE, in seconding the resolution, said he did so as a member of the Debenture-holders' Committee. They realised that it was a very bad outcome of the business, but having carefully looked into the matter, they advised their fellow-holders to accept the scheme, lest something worse might befall them.

MR. MIDDLETON asked what was the value of the stock of the Newcastle company which they were asked to accept.

MR. T. A. HARDMAN remarked that, in his opinion, the company was in a rotten position in 1908, and the best thing would have been to have wound up then.

The CHAIRMAN, in reply, said that the position of the Newcastle company was quite sound, and was improving. They had just paid 5 per cent. dividend on their ordinary shares, and the market price to-day was about £4 for a £5 share. He did not think any of the directors could be blamed for the present position, because not only were the company's technical experts at fault with regard to the revenue which would be produced, but those estimates were practically confirmed by the engineers of the Newcastle company. The position was that a load of this kind was practically unknown in this country—they hoped for a 60 or 70 per cent. load, but they had never got more than 40 per cent.

The resolution was carried without a dissentient.

Tramways, Light and Power Co., Ltd.—The statutory report submitted at the meeting held in London last week states that the total number of shares allotted is 475,007 of £1 each (300,000 6 per cent. cum. preference shares, 90,007 ordinary shares and 85,000 deferred shares). 300,000 preference shares and seven ordinary shares have been allotted, payable wholly in cash. 45,000 ordinary shares and 85,000 deferred ordinary shares have been allotted, credited as fully paid-up, in part payment of the purchase consideration, and 45,000 ordinary shares have been allotted, credited as fully-paid up, in part payment of underwriting commission. The total cash received by the company to date in respect of the shares issued wholly for cash is £185,511.

Huelva Gas and Electricity Co., Ltd.—The report states (says the *Financier*) that the net profit for 1912, including the balance brought forward, amounts to £1,648. After providing for the dividend on the preference shares, £1,000 is to be written off for depreciation of gas and electric plant.

Globe Telegraph and Trust Co., Ltd.—The directors have declared an interim dividend of 2s. per share on the ordinary shares for the three months ended February.

Canadian General Electric Co., Ltd.—The directors have declared a quarterly dividend of 1¾ per cent. for the three months to March 31st (at the rate of 7 per cent. per annum) on the common stock, and a half-yearly dividend of 3½ per cent. for the six months ended March 31st (at the rate of 7 per cent. per annum) on the preference stock.

Ascot District Gas and Electricity Co.—At the annual meeting recently held, it was stated by the chairman that the gas manager, Mr. A. E. Brooks, had made himself quite expert as an electrician. The speaker referred to the all-round economy and efficiency resulting from the manufacture of gas and electricity under one management in one undertaking, and said that gas companies were the right authorities to do electricity supply. The year showed an increase of 15·7 per cent. in electricity sold, and an increase of 6·07 per cent. in gas supplied.

Farnham Gas and Electricity Co.—The chairman at the recent annual meeting said that the electricity department started last May was increasing its income, especially from slot meters, and it would not be long before it was paying its way.

Direct Spanish Telegraph Co., Ltd.

Sir John Denison-Pender, K.C.M.G. (chairman), presided on Monday at Electra House, E.C., over the meeting of this company.

The Chairman, in proposing the adoption of the report (see Electrical Review, page 441), said it was gratifying to the board to be able to report an increase in the traffic receipts of nearly £3,000 as compared with the year 1911, and also to report that the traffic from January 1st, up to the present date, also showed a slight increase over the figures of last year. The working expenses were £1,079 in excess of those of last year. Salaries in London had increased by £86, due to normal increase under the salary scheme and to the fact that extra assistance had been required owing to the continued increase in the company's business. Salaries at stations showed an increase of £678, which was partially due to normal increase and partly to the improvement in the salary scheme of the operating staff, which the directors found necessary in the interests of all concerned. No interruption of the company's cables had taken place during the year under review, and this had enabled the directors to place the sum of £11,000 to reserve, which they considered good policy, in view of the very heavy expenditure they were obliged to incur in 1911 in connection with the extensive renewal of the Bilbao cable. It must also be remembered that it would be necessary to realise some of the company's securities to enable them to redeem the necessary debentures in June, 1914. The securities now stood in the company's books at £83,956, which was the cost price, but the depreciation, which was something over 16 per cent., or £13,750, had to be deducted from the amount standing in the accounts.

Mr. F. A. Johnston seconded, and the report was adopted without discussion.

The retiring director, Mr. Johnson, having been re-elected,

Mr. S. Collett proposed a vote of thanks to the board. He said the company had passed through difficult and troubled waters, but the directors had steered the ship very wisely, and to-day they had arrived at a very satisfactory state of things. He believed they had never before put by such a large sum as £11,000 to the reserve fund, and in view of the fact that the debentures would be paid off next year, their prospects certainly seemed brighter than for several years past.

The motion having been carried,

The Chairman replied on behalf of the board and the staff, and said that last Christmas he visited the Bilbao station and saw a great many of the staff there, and he complimented the company on the fact that the station was in perfect order, and everything bore a thoroughly business-like appearance.

Bournemouth and Poole Electricity Supply Co., Ltd.

Mr. Aymor H. Saunderson (chairman) presided, on March 13th at Moorgate Court, E.C., over the annual meeting of this company.

In moving the adoption of the report (see Electrical Review, page 394), the Chairman went through the various items in the balance-sheet, and pointed out that £1,761 had been added to the leasehold and special redemption accounts. The slot meter reserve, amounting to £2 671, had also this year been transferred to this account, which now stood at £19,096. The loan account stood at £30,500, as against £24,000 last year, the increase being due to a loan from the bankers for temporary purposes. On the asset side the amount expended on capital account stood at £469,577, of which £9,371 was spent during the year. The amount actually expended was £11,051, and the difference was accounted for by machinery written off during the year amounting to £1,680. As in previous years, the greater portion of the expenditure had been on mains extensions, and this was inevitable in an undertaking such as theirs, as they had such an extensive area to supply, and new residential districts were continually being opened up. This, of course, was a healthy feature, and one on which they congratulated themselves. As to the investment in the Richmond company, a loan of £2,200 had been advanced to that company during the year. The chairman next dealt in detail with the revenue account, and pointed out the various small increases and decreases. There was an increase of £2,358 in the item for coal, waste, &c., and there was an item of £174 for the insurance and superannuation fund, which, he thought, was an item which would commend itself to the shareholders. The company suffered considerable loss from the coal strike and the transport workers' strike, in common with all other electrical supply companies, and the local directors and Mr. Ingram, the chief engineer, had a very anxious time while the strikes lasted. Now the trouble was over they had the satisfaction of knowing that the steps they took to cope with the difficulties were the best they could have taken, and he was glad to report that the continuity of supply of current was not affected in the slightest degree. They estimated that the trouble cost them approximately £1,800, which they might otherwise have raked into their coffers, and could have used for paying an extra 1 per cent. to the ordinary shareholders, or else have utilised to strengthen their reserves. The repair of meters cost them £286 extra, due to their having overhauled all the meters both in stock and in their consumers' premises. Altogether, during the year they had written off £7,309 on various accounts, which was equal to 4·93 per cent. on the ordinary shares of the company. It appeared to him that their position might be summed up as follows: First, they showed an increase in the gross receipts from all sources of £5,604 over the previous year. Secondly, £7,399 had been added to depreciation reserve and redemption funds. Thirdly, the reserve for depreciation now stood at £84,703, as against £81,383, showing an increase of £3,320. Fourthly, the dividend on the ordinary capital was at the rate of 6 per cent. per year, compared with 5½ per cent. for the three previous years. Fifthly, the carry forward amounted to £2,144 against £1,209 for 1911. The general progress of their business had been, he was glad to say, quite satisfactory during the year. The applications for the supply of current received during the year amounted to 613 kw., as compared with 535 kw. in 1911, thus showing an increase of 14 per cent., and the units sold were 3,338,425, as against 3,078,316 in 1911, being an increase of 8 per cent. During the past year the rates of supply to the Bournemouth Corporation for tramway traction had been revised in accordance with the provisions of the agreement, which contained powers to revise the rates every five years. The matter necessitated careful and lengthy negotiation, and ended in a friendly adjustment of the price, and hence the costly resort of arbitration was avoided. With regard to the Richmond Electric Light and Power Co., in which they held a large interest, it was a matter for congratulation that the company had been enabled to pay them in respect of last year a much larger contribution to their revenue than usual. It had maintained its position and given satisfaction to them in every way. They would remember that, at the last meeting, he told them he believed the time had passed when metallic-filament lamps could have anything but a most beneficial effect on their revenue, and he was glad to say that the results quite justified that view. The lamps rendered the current cheaper to the consumer, and were making electric light far more popular than before. Practically all the chairmen at the meetings of the electric supply companies which had been held that year told them that last year had seen a great increase in the quantities of electricity supplied to their consumers compared with the previous year, not only for lighting, but for heating, cooking and power purposes. He was convinced that the electric supply industry, generally speaking, had a very bright future before it. The Bournemouth Co. had certainly not lagged behind, and their prospects of increased business during the present year were distinctly encouraging, and he hoped next year to come before them with a statement showing improved results all round. In conclusion, the chairman referred to the appointment of Mr. H. B. Renwick, the former secretary, as managing director, the appointment of Mr. W. D. Brightman, previously local secretary, as secretary of the company, and the appointment of Mr. F. C. McQuown as London secretary.

Dr. J. Atkinson Hosker seconded the motion, and the report was adopted without discussion.

In acknowledging a vote of thanks passed to the board and staff, the Chairman said he would convey the shareholders' appreciation to the staff at the staff dinner which it was proposed to hold shortly, when the food would be cooked by electricity.

Prospectuses.—*Clyde Valley Electrical Power Co.*—The list of subscriptions was to close on Wednesday, 19th inst., in an issue of 30,000 6 per cent. cumulative preference shares of £10 each at par. The development of the business renders extensions to generating plant, cables and sub-stations necessary, and it is for providing capital for these purposes, for further extensions in the future, and for the repayment of temporary loans that the present issue has been made. The profits for 1910 were £29,316, for 1911 £45,782, and for 1912 they were £54,440, notwithstanding coal strike effects and consequent dislocation of business.

The Cuban Telephone Co.—The list was closed on 14th inst.—earlier than was expected owing to its success—in an offer of $1,500,000 6 per cent. cumulative convertible preferred stock in shares of $100 each at £19 per share, equivalent to, say, $92½ per $100 share. The company, which has already issued $5,000,000 common and $2,000,000 preferred stock, has acquired very large holdings in the Havana Telephone Co. and the Havana Subway Co. The proceeds of the present sale of preferred shares will be applied to further construction, extension and betterments rendered necessary by the growth of the company's operations. The Havana old telephone system was superseded at November, 1910, by the automatic, and the number of subscribers is now 11,494, and the ultimate capacity is 100,000. The business and the receipts are showing continuous increases. The concession confers the right, without limitation of time, to install and operate a general and long-distance telephone system extending over 1,000 miles, covering practically the entire island of Cuba.

Rhondda Tramways Co., Ltd.—The accounts for the year 1912 show a balance to the credit of the revenue account of £18,680. After deducting rent to the Rhondda U.D.C., debenture interest, sinking fund for the redemption of debentures, interest on loan, &c., there remains £2,778, plus £1,198 brought forward. There is to be placed to reserve and renewal account £2,000, carrying forward £1,976. It is estimated that the profit for the year was adversely affected to the extent of at least £6,500 by the national coal strike and by the strike of the company's drivers and conductors in May. For the six months to June 30th, during which these labour troubles prevailed (according to the *Financier*) the traffic receipts were £19,700, but for the second six months they were £30,000. The company is promoting a Railless Traction Bill in Parliament to enable it to serve a large and increasing colliery district about six miles from Tonypandy.

Dublin and Lucan Electric Railway Co.—The gross receipts for the half-year ended December 31st are £3,867, being £93 less than those of the corresponding period of 1911. The expenditure increased by £177. After providing for debenture interest and paying the usual half-yearly dividend on the 5 per cent. preference shares, £378 is to be carried forward.

Gateshead and District Tramways Co., Ltd.

Mr. C. R. Greene presided on March 13th at the offices, Kingsway, W.C., over the annual meeting of this company, and in moving the adoption of the report (see Electrical Review, page 444), he said that the excellent result of the past year's working had constituted a record. The profits on working showed an increase of £364 over 1911, and the directors were in a position to recommend the payment of a bonus of 1 per cent. on the ordinary shares in addition to the usual 6 per cent. dividend. Traffic receipts showed an increase of £572, and this was most satisfactory in view of the labour troubles during the year. The company benefited materially during the period of the coal strike from the reduced railway service in the districts served by the tramways, but when the strike was over the increase was soon lost, owing to the effect of the strike on general trade. Traffics, however, picked up rapidly again towards the latter part of the year, and they finished on December 31st with an increase of £572. The satisfactory expansion in the receipts had been continued in the current year, and the prospects so far for the current year were good. During the year the company took the whole of the advertising on the cars under its own control, and the change had been satisfactory. Turning to the other side of the revenue account, power and running expenses showed a decrease due to decreased current consumption, to which the fitting of meters on the cars had materially conduced. There were 6,572 more car-miles run during the year. Having regard to the size of the undertaking and the work carried out the administrative and general expenses were on the low side. During the year the National Insurance Act came into operation, and in future years this would cost them considerably more. Repairs and maintenance had increased by £627, due to the heavy expenses on the bodies of the cars. Most of the cars were now 12 years old, and the wood-work needed extensive repairs. Nine cars were constructed during the year, and the whole cost had been charged against revenue. Repairs and renewals to the electric equipment and trucks of the cars had cost £252 less. Permanent way repairs were up £142, and in addition £485 had been spent on renewing portions of the track, and charged against renewals account. £1,473 had been expended on the motor-'bus undertaking. Applications had been received from time to time from local authorities in districts adjoining Gateshead for the company to extend their tramways, but the board after careful consideration felt that this would not be profitable. Application had, however, recently been received from the Chester-le-Street Urban District Council for them to provide a regular service of motor-'buses between the tramway terminus and Low Fell and Chester-le-Street. On careful consideration the directors decided to give the service, and nine 'buses of the latest type had been purchased, and a garage was in course of completion at Chester-le-Street, and it was hoped to commence the service within the next few weeks. There was every prospect of the service being a success, and there was always, in addition, the traffic brought by the omnibuses to the tramways. They had a further advantage in the form of the excellent tramway organisation, which would help to keep the expenses of the omnibus department at a minimum. There were other omnibus routes which the directors had under consideration, and one of the most promising was that between the tramway terminus at Felling and Usworth to Washington. The Chester-le-Street Rural District Council, in whose area these places were situated, had approached the board on the matter, and had provided them with useful information and assistance. As soon as the Chester-le-Street service was completed, it was proposed to operate an experimental service from Washington to Felling. The "pay-as-you-enter" cars had operated satisfactorily during the year, but owing to the exceptional influences affecting the traffic on the Bensham and Saltwell routes upon which these cars were running, it had not been possible to satisfactorily ascertain the effect on the traffic receipts. The directors, however, were satisfied that the results had been beneficial, and, as new cars were needed for the Lowfall route, the directors had authorised the construction at the depôt of two new cars on the "P.A.Y.E." principle. The directors congratulated the shareholders on the results of the past year, and, in the absence of further strikes in the labour world, similar results might be anticipated for the current year. The general results of the undertaking had been materially assisted by the loyal way in which the whole of the staff in Gateshead and in London had worked.

Mr. C. S. B. Hilton seconded the motion, and it was carried without discussion.

The retiring directors were re-elected, and a resolution was carried, on the motion of Mr. Bower, seconded by Mr. Bowker, fixing the remuneration of the board for the year at £450.

Brompton and Kensington Electric Supply Co., Ltd.

Mr. H. R. Beeton (chairman) presided on March 13th at Winchester House, E.C., over the annual meeting of this company.

The Chairman, in moving the adoption of the report (see Electrical Review, page 444), said that the accounts revealed the satisfactory progress of the company's business. During the past year they connected 345 additional customers, which was a larger number, with two exceptions, than in any previous year, and 13,147 35-watt lamps, which was the largest number since 1906. The sales of electricity had for the first time exceeded 3,000,000 units. The income therefrom was £56,348 being an increase of £1,618, whilst the expenditure had amounted to £23,170, being a decrease of £868, thus showing an increased profit of £2,486 over the previous year. This result was largely due to the fact that, owing to the more economical plant they now had in operation, they had consumed 1,820 tons less coal, and had thus been able to save £478, notwithstanding that, owing to the strike, they had had to pay about 1s. per ton more. But for the introduction of the turbine plant their coal cost last year would probably have been £2,000 in excess of what it actually was. The growth of business had at length overtaken the reduction in demand which the metallic-filament lamp entailed upon them, to the advantage of their customers, and the gross and net receipts once more constituted a record in the company's history. In a purely residential district and at a pressure of 100 volts, as in their case, the metallic-filament lamp found its most profitable field, and he thought they might assume that the invention in its present stage of development had reached its full application in their area. In other words, they had not only been called upon to bear, but they had now faced, the full brunt of the metallic-filament lamp, and it would be interesting, therefore, to compare their position now with the position in 1907, before the advent of this current-saving device. Broadly stated, the position was that although they were now selling rather more current than in 1907, they were supplying about 30 per cent. more customers and lamps, and at the same time the maximum demand for current which they were called upon to supply at any time was actually less by more than 10 per cent. From this it followed that, inasmuch as their maximum demand determined the extent of the plant they required, they had now a larger reserve of plant to meet future expansion of business, and that the smaller extent of plant required was more fully, and, therefore, more profitably employed. In short, their "load factor," as it was technically called, which was the measure of the profitable character of their production, had risen from 16 per cent. to 18¼ per cent. It was to the use of electrical accessories, which they had assiduously fostered of late years, that this improvement was due, and as such use extended, as it assuredly would, this favourable tendency would continue. Moreover, not only did they now require less plant to do the same business, but the plant installed was so much more economical than that which was installed five years ago, that they could now produce the same quantity of current at more than 10 per cent. less cost. This relief from additional capital expenditure, in conjunction with the accumulated profits in the interval, had enabled them to substitute up-to-date for obsolete plant to the extent of about £30,000 and at the same time to increase their reserve funds by another £30,000. On the basis of the appropriations which they now recommended, their reserves and undistributed balances would amount to upwards of £120,000, or 60 per cent. of their subscribed capital, and the radical demolitions of plant shown in the depreciation account of last year would permit of a reduced appropriation of this nature in the near future. In order to maintain their prosperity in a progressive industry, such as that in which they were engaged, they were obliged to keep up with the latest developments, and since they last met them the board had continued to be actively engaged in the study of electric cooking through the agency of the Accessories Co. As he had occasion to tell them last year, they looked for considerable improvement in supply from this source, and at the same time they were confirmed in the expectation that they might be able to turn to profitable account the experience they had gained in the development of cooking appliances. To this end, and by way of demonstrating the advantages, and especially the reliability, of electric cooking, the Accessories Co. was opening the first all-electric restaurant in London, on premises adjoining their showrooms, at an early date. They did not conceal from themselves that there was a speculative element in this departure, but even so, it was one which their surplus resources justified them in entering upon. So far as they could judge of the prospects for the current year, they looked forward to at least as satisfactory results as those they had achieved in the year now under review.

Mr. W. R. Davies seconded the motion.

Dr. Berkwell asked how the cost of electric cooking compared with that of gas.

The Chairman said that it was difficult to give an answer to the question without causing some misapprehension. It depended largely on the cost of current; just as electric lighting progressively declined in cost, so could electric cooking. The fact was that experience showed that electric cooking was a vastly superior form of cooking, and had advantages associated with it which did not exist in the case of gas or coal. He believed it would grow to such an extent, that eventually they would derive a greater revenue from cooking than from lighting.

Mr. Fox having congratulated the company on the enterprising manner in which it had encouraged the use of electricity for domestic purposes,

The report was adopted.

The retiring director, Mr. Davies, was re-elected, and the meeting closed with a vote of thanks to the board.

Stewarts & Lloyds, Ltd.—The directors, after setting aside £100 000 for depreciation, recommend, subject to audit (says the *Financial News*), the usual dividend of 10 per cent. on the preferred ordinary shares and a dividend of 1s. 6d. per share on the deferred shares, placing £50,000 to reserve, and carrying forward £90,000. Last year 1s. per share was paid on the deferred shares, £70,000 each applied to both depreciation and reserve, and £86,500 carried forward.

City of London Electric Lighting Co., Ltd.

MR. J. B. BRAITHWAITE (chairman) presided on Wednesday last week, at Salisbury House, E.C., over the annual meeting of this company.

The CHAIRMAN, in proposing the adoption of the report (see ELECTRICAL REVIEW, p. 400), said that so far as their business was concerned the year had been a normal one. The capital expenditure, £45,508, was almost identical for the last two years, and the whole of this had, in accordance with the practice of some years past, been provided out of revenue: so that there had been no occasion to make any additional issue of capital. During the year the completion of further turbine generating plant had released the greater portion of the old alternating current plant, which, although seldom used, had been retained as a reserve. They had, therefore, disposed of it, and had entirely written it off. This accounted for the fact that £191,150 had been written off plant, as compared with £45,000 a year ago. The fact was that they had now written off and scrapped the second generation of their generating plant, if he might use such an expression: the first plant put in in 1891 had disappeared from their station for some years, and had been entirely written off, and now they had removed the last remains of the second generation of generating plant altogether, and there was nothing in their station now except comparatively modern plant, although, of course, there was plant which in due time would ripen for removal, and then from year to year they would put in more and more modern plant. It was the adoption of this policy which had enabled them to pay increasing dividends. The result of the writing off that year would be that the total reserve funds would now show the figure of £240,000, as against £377,127 a year ago. This was after placing the increased amount of £50,000 to the depreciation reserve. As to the reserve they had experienced an advance almost identical with that of last year. Last year the revenue showed an increase of £9,455, and this year it showed a further increase of £9,035, so that during the last two years, their revenue had increased to the extent of £18,500. Last year out of the increase of £9,000, they were able to retain over £5,000 net. This year they would have done equally well had it not been for the coal strike and the transport strike, which materially interfered with their coal supplies, and also had the effect of raising the prices of coal; the rise was still continuing. On account of these strikes they had to pay £4,194 additional for coal. They had also this year felt the full effect of the quinquennial valuation, resulting in a further increase of the rates of £882. These, and other items had increased their expenses altogether by £7,220, so that of the £9,000 increased revenue, they had only been able to retain £1,850 as net. In the report they had set out how it was proposed to dispose of the balance available, and he would only call attention to one item, viz., contribution to employés' provident fund, and under the National Insurance Act, £1,804. In 1902 the shareholders gave them authority to become contributors to the British Electrical Superannuation Fund, but the constitution of that fund did not appeal to a large portion of the staff, and up to 1911 the company were never called on to contribute more than £400 a year, and owing to various circumstances the board had thought it well to withdraw from that fund, and had decided to establish a staff provident fund of their own, which was greatly appreciated by their staff, and there were now 140 members contributing to it. Their contributions for that fund this year would amount to £1,800, and he thought the shareholders would agree that no portion of their expenditure was more wise than that which went to make proper provision for the loyal and faithful members of their staff, who earned their dividends, when in due course their places would be taken by younger men. Therefore he anticipated that the resolution he was going to ask them to pass could be passed unanimously, giving approval to the scheme they had set on foot. They had made further progress in reducing the loan to their bankers and generally improved their financial position. Whereas, the bankers' loan stood last year at £85,000, it had now been reduced to £59,000. On the other hand, the amount due to their creditors was about £12,000 more, and investments were £4,000 less, so that the financial position showed a net improvement of £10,000 in the course of the year. With regard to public lighting there was nothing fresh to report beyond what was mentioned last year, that an agreement had been come to with the Corporation by which the public lighting in the City would be approximately divided between the Gas Co. and the Electric Lighting Co. In the report there were some particulars given with regard to the right of the Corporation to purchase their undertaking in 1914. So far as he was aware the Corporation had no intention of exercising that right. That was to say they had received no communication from them which would lead them to suppose they had, but, of course, their right did not arise until next year. He merely said that because there had been rumours in the papers that the Corporation were actually considering the question and that negotiations had been entered into. Nothing of the kind had taken place at all, and he had no reason to believe they had any intention of exercising their right of purchase. It was fair, however, that he should say that if the Corporation did not exercise their right next year the right would entirely lapse. Under the recently passed Electric Lighting Act the County Council became the ultimate purchasing authority of all the electric supply undertakings of London in 1931; and that being the case, unless the Corporation exercised their right next year, the view of the company was that their right lapsed entirely. The average price received for current was still slightly on the down grade, and they received an average of 2·37d. per unit, as against 2·39d., which, of course, was an answer to people who said they overcharged for current. The number of consumers being supplied showed an increase of 483 over 1911, and the number of KW. connected showed an increase of 2,029, so that evidently the City, as a field of electrical supply, was by no means exhausted. They got a considerable number of applications for connections, and one could only suppose that the use of electricity was extending in all directions. There was still, he thought, a considerable field for its use for heating in various directions, and he anticipated that they would see a considerable growth in that source of revenue in future years. Apparatus was now supplied at a very low rate, which enabled the occupier of any office in the City to have all the facilities of hot water and that sort of thing for a very small expenditure of money. They must look forward in the future to a gradual and steady growth of their load, and also, he hoped, in the results to the company. This year the board recommended a bonus of an extra 1 per cent. out of the dividend equalisation account they started some years ago to make provision for a possible drop in their revenue, due to the introduction of the metallic-filament lamp. So far as they could judge, that danger no longer existed, and therefore they felt justified in distributing half the fund by way of a bonus of 1 per cent., which would make the dividend for the year 9 per cent. On previous occasions they had never made an advance in their dividend unless they saw their way, humanly speaking, to maintain it, and he need not say that the same consideration had been present in their minds on this occasion.

MR. F. W. REYNOLDS seconded the motion.

MR. HEDGES asked if there were any particular terms on which the Corporation would acquire them if they exercised their rights, and whether the board considered it would be to the advantage or otherwise of the company to be bought out.

The CHAIRMAN said the Corporation would have to buy them as a going concern, with payments for goodwill and all the rest of it. He did not know that he ought to be asked to express an opinion as to whether it would be to the company's advantage to be bought out. That would depend on the arbitrator. They were quite content with their undertaking, but, of course, seeing that they were paying 9 per cent., the City would be able to raise money much cheaper and probably make something towards the rates.

The report was then adopted, and resolutions were also carried re-electing the retiring director and approving of the action of the directors in forming a Staff Benefit Fund.

Cambridge Electric Supply Co., Ltd. — Mr. D. Munsey presided at the annual meeting held in February, and in presenting the report (see ELECTRICAL REVIEW, page 314) he said that the year had been a very successful one. They had sold 110,000 more units than in 1911 (lighting increase, 83,000 units; power, 27,000 units). The extension of business had been going on in all directions, and their extra profit was £1,400, out of which an extra £750 would be put to depreciation account, and ½ per cent. more would be paid in dividend. Their depreciation addition for the year, £3,500, was not too much. They not only had coal enough to last through the whole of the strike, but could have lasted another four or five weeks. Mr. A. A. C. Swinton seconded, and the report was adopted, and the dividend of 5½ per cent. declared. There was a vote of thanks to the staff, the chairman specially mentioning Mr. R. C. Pierce (the engineer) and Mr. J. H. Taylor (the secretary).

Australia.—According to the *Australian Mining Standard* the Electric Light and Power Supply Corporation, Ltd., Balmain (N.S.W.), for the half-year ended December 31st, made a profit of £6,006, of which after deduction of interest on debentures, there remained £3,505. A dividend at the rate of 7 per cent. per annum absorbed £1,505, suspense and preliminary expenses account, £1,000, depreciation £865. The private consumers totalled 1,203, an increase of 563 for the year. Portions of the new 2,000-H.P. turbo-generator were delivered early in the year 1913, and it is expected that it will be in operation before the capacity of the present machinery is reached. Owing to the increase in population in Balmain, a larger quantity of garbage was collected, and it was found advisable to provide for the garbage being burnt in one shift per day by installing an additional cell; this is completed and working satisfactorily.

Davis & Timmins, Ltd.—At the annual meeting held at King's Cross last Friday, Sir Henry Mance, in moving the adoption of the report, referred to its satisfactory nature. Last year he informed them that the bonus, in addition to their 8 per cent., would be 5 per cent., and this year they were justified in recommending that it be 10 per cent. This was a record. In 12 or 13 years, though the capital was only £107,000, they had paid to shareholders in dividends £109,000. In 1912 business was remarkably good. Increased business had necessitated increased machinery, and no expense was spared to keep the latter up to date. Stock items were, of course, larger on account of the increased volume of business. In regard to prospects, judging from the two months' working so far, they had no reason to think that 1913 would be any worse than 1912. The works were full of work. The chairman thanked the energetic managing director, Mr. G. E. Davis, and the staff, for the excellent service rendered during the year. The report was adopted.

Mirrlees Watson & Co., Ltd.—The directors state that the balance at credit of profit and loss account for 1912, after providing for depreciation and directors' fees, amounts to £32,719, plus £2,478 brought forward. The directors recommend a dividend of 10 per cent. and a bonus of 5 per cent., less income-tax, and that £12,500 be transferred to the general reserve account, £5,042 being carried forward.

Greenock and Port Glasgow Tramways Co., Ltd.

The directors report that the total revenue for 1912 was £43,383. The traffic receipts, which amounted to £42,214, show an increase of £4,267. After providing for all expenses chargeable to revenue, including £2,137 for interest, payments to Corporations amounting to £1,448 and setting aside £4,000 to the renewals account, there was a surplus on the year's working of £13,296, plus £1,072 brought forward. The directors propose to put to reserve sinking fund for loan redemption £1,773, to reserve £1,200, to pay 5 per cent. per annum on the preference shares £3,500, a dividend at the rate of 6 per cent. per annum on the ordinary shares £6,900, leaving £996 to be carried forward. The capital expenditure during the year amounted to £2,591, the greater portion of which was in connection with the purchase of motor-omnibuses. The directors believe that with the reliable vehicles now available there is scope for a profitable service of motor-omnibuses in the Greenock district, and a service will be commenced in the early spring of the present year, for which purpose six chassis of the latest type have been arranged for. The continued activity of the trade in the district is reflected in the satisfactory increase in the traffic receipts, and there are indications that equally good results will be experienced during the present year.

	1911.	1912.
Miles open:—Routes miles	7·42	7·42
Single line	·81	·81
Double line	6·61	6·61
Passengers carried	9,235,976	10,493 274
Average receipts per passenger	·97d.	·96d.
Average working expenditure per passenger	·50d.	·51d.
Proportion of working expenses to receipts	51·2 %	52 %
Cars working	43	43

Oxford Electric Co., Ltd.

Sir Henry Mance presided at the annual meeting on March 7th, and in moving the adoption of the report (see Electrical Review, page 359), he referred, first of all, to the death of Sir J. Irving Courtenay, a director of the company since its inception. The chairman's observations respecting the accounts were then read by the secretary, after which Sir Henry, in referring to general matters, said that at the close of the coal strike they still had a month or six weeks' supply of fuel in hand. The result was, of course, unfavourable to their coal figures; but thanks to the partial assistance of the Diesel engine, which they had had running for some months, the figures were just as good as in the previous year. They had learned the wisdom of not being dependent upon a particular kind of coal or fuel, and they could get some by water and some by rail. The Shops Closing Act had had a noticeable effect on revenue derived from shopping districts; but, perhaps, the most important thing against them had been the metallic-filament lamp. They had, however, now touched bottom in this respect. They had added 146 new consumers, including some of the college buildings, &c. The equivalent of 10,000 lamps had been connected to the mains. They were hoping for a more rapid increase in the electric cooking business; appliances had been steadily improved, but the great difficulty was the objection of the cooks. They had been brought up to use coal, and did not like to try anything strange. In regard to the tramways, if the proposals now before the City Council did not succeed, he thought the alternative for tramways was self-contained traction cars, which had answered very well in other parts of the world. What, he thought, was wanted was a new battery—one durable, reliable and cheap—that would do for electric traction what the metallic-filament lamp had done for electric lighting.

The report was adopted, and Prof. T. L. Bullock was elected a director.

The meeting closed with thanks and best wishes to Sir Henry Mance, who has been associated with the company for 20 years.

STOCKS AND SHARES.

Saturday Morning.

Markets round the Stock Exchange threw off some of their depression after the conclusion of the settlement. It happens generally that prices are advanced on the eve of a holiday, this being one way in which the incurable optimism of the Stock Exchange asserts itself year after year. Prices, moreover, had had a very considerable fall, and it was time that there should be some kind of upward reaction, for no small part of the decline was due to the simple process of marking down quotations, irrespective of any sales taking place.

The Home Railway market presented a firm front, on the assumption that prices here had reached levels which discounted a good deal of trouble. Taking the list through, a good selection of British railway stocks can be bought to yield from 5 to 5½ per cent. on the money, and such returns cannot be ignored, even in times like these. The Undergrounds are somewhat overlooked in the better feeling that prevails in the market as a whole, though Districts rallied to 51¼, and Metropolitans to 51½. Business has been done in Central London Ordinary up to 79½, and it would require very little demand to put the Central London trio substantially better. A fair amount of speculation in East London is a feature amongst the lower-priced issues, bullishness having been fanned by irresponsible whispers that the stock was being bought up by some of the powerful interests connected with what has been called the Traffic Trust.

English Electric Supply shares are now mostly *ex* their spring dividends, and on Thursday last, dividend deductions were made from County of London, City of London, Chelsea, Charing Cross, Oxford, Kensington, and London shares. Cities are *ex* 12s., this being the dividend and bonus. It will be seen from our lists overleaf that the return on the Ordinary shares of the principal electric lighting companies is now round about 5½ per cent. on the money; and if it were not for the uncertainty attaching to the prospect of what may happen to the companies in 1931, it is safe to assume that prices would stand considerably higher. As things are, however, brokers scarcely like to recommend the shares for investment, having regard to the obscurity of the prospect. Could this be lightened in any way, there is no doubt but that the electric lighting group would become a great deal more popular than it is at present.

In the Latin-Canadian department, it is increasingly evident that South American undertakings require ever more and more capital to meet their need of expansion. The railway companies are the principal claimants, but their appeals for money react upon the shares in the utility concerns as well as those which are more directly concerned with their own industry.

The position in Mexico is still far from settled, and although it is generally assumed that the worst has been seen in that country, there is still a possibility to be reckoned with of some fresh, unexpected outbreak. Mexican Light and Power Seconds are easier, and there has been a little selling of Mexico Tramway bonds, but there is not much quotable change in the rest of the Mexican securities. Sao Paulo Trams went back a little, the loss being picked up, however, by Sao Paulo Electric Fives. Rio bonds are steady. Shawinigans are a point down, and Montreal Common shares at 227½ show a fall of 3.

We took the opportunity of having a long talk the other day with a gentleman, back a fortnight ago from the United States, who spent a day on the property of the Mississippi Light and Power Company, and he bore emphatic testimony to the wonderful piece of engineering work that has just been accomplished. We understand that the machinery is all but ready to commence work, and the result of the operations will be watched with intense interest. The Company's Common shares have recently fallen to the neighbourhood of 50; and while the Stock Exchange remains so non-commercial and unenterprising as at present, it is not likely that there will be much revival in the price. Quiet business, however, is being done in the 5 per cent. bonds at 90½.

Remembrance of the Georgia Light and Power episode is still with us, and those who bought the shares when they were run up to about 47 upon anticipation of a 4 per cent. dividend are not likely to pay much heed to the renewed talk of a distribution being made in the near future. Such rumours are afloat, however; and while we should hesitate to place much reliance upon them, they are certainly of interest. Of course, if the Company should pay a dividend this spring, it will certainly provide a very pleasant disappointment to many of the proprietors. The price of the shares keeps steady at about 39, while Alabamas at 44 are equally stagnant.

The Cuban Telephone issue of 6 per cent. Preferred stock, to whose advent we referred two or three weeks ago, has now been made, and the security looks good, while the price of 92½ cannot be called excessive. The Melbourne 5 per cent. Debenture stock, which came out last week at 93½, was, we believe, fully subscribed, but the lists have to be kept open a few days longer for the Australian subscriptions. There are buyers of the scrip in the market at 1 premium for cash.

National Telephone Deferred is quoted at 19½ *ex* the 75 per cent. return that was made to proprietors on Thursday last, but the reduction in the price of the stock has not stimulated speculation to any extent. On the other hand, Marconis have started into fresh life upon covering by the bears. Such, at least, is the Stock Exchange theory to explain the demand, though whether it is the correct reason for the improvement or not, it is difficult to say, in view of the very stiff contango rate charged on the shares last Tuesday. The price at 4⅜ shows a rise of $\frac{9}{16}$, while the Preference shares are ¼ higher. West India and Panama shares went back to 3.

The Anglo-American group is unchanged, but the market is watching somewhat narrowly for manifestations of the new President's probable policy in regard to trusts. To judge from his first efforts, Dr. Woodrow Wilson is likely to be at least as erratic as was his famous predecessor-before-last. Globe Telegraph Trust shares rose ½ over and above the dividend deduction at 2s. The Mackay issues are *ex* dividend, allowing for which there is little change in the quotations. United River Plate Telephone Preference have been in some demand, and Oriental Telephones hardened, while Telephone of Egypt 4 per cent. Debenture stock is a point up.

The Manufacturing division is quiet, though there is much talk of the strong accession of business which the companies are declared to have gained by reason of the trade boom. The market for raw rubber remains steady at about 3s. 11d. per lb. Many of those who have been watching it, express disappointment at the failure of the commodity to improve in price, but the steady way in which large supplies of rubber come forward every fortnight at the Mincing Lane auction sales is sufficient reason to account for the disinclination of consumers to buy more than they require for their immediate purposes.

SHARE LIST OF ELECTRICAL COMPANIES.

ENGLISH ELECTRICITY SUPPLY AND POWER COMPANIES.

NAME.	Stock or Share.	Dividends for 1911.	Dividends for 1912.	Closing Quotations Mar. 15th.	Rise + or Fall —	Present Yield p.c.
	*					£ s. d.
Bournemouth & Poole, Ord.	10	5½	5†	9⅜ — 10⅛	..	5 4 9
Do. 4½ % Pref.	10	4½	4½	8⅞ — 9⅜	..	4 14 9
Do. Second 6 % Pref.	10	6	6	9⅞ — 10¼	..	5 17 1
Do. 4½ % Deb. Stock	Stock	4½	4½	96 — 98	..	4 11 10
Brompton & Kensington, Ord.	5	10	10	8⅞ — 9⅜	..	5 6 8
Do. 7 % Cum. Pref.	5	7	7	8½ — 9	..	3 17 9
Central Electric Supply, 4 % Guar. Deb.	100	4	4	95 — 98	..	4 1 8
Charing Cross, West End & City	5	5	5†	4⅜ — 4⅞ xd	..	5 2 7
Do. 4½ % Cum. Pref.	5	4½	4½	4⅛ — 4¼	..	4 14 9
Do. "City Undertaking" 4½ % Cum. Pref.	5	4½	4½	8⅞ — 4⅜	..	5 2 10
Do. Do. 4 % Deb.	100	4	4	91½ — 93½	..	4 5 7
Chelsea, Ord.	5	5	4†	4½ — 5 xd	..	5 0 0
Do. 4½ % Deb.	Stock	4½	4½	96 — 99	..	4 10 11
City of London, Ord.	10	8	9	16 — 17½ xd	..	5 2 10
Do. 6 % Cum. Pref.	10	6	6	12 — 13 xd	..	4 10 7
Do. 5 % Deb.	Stock	5	5	116 —120	..	4 3 4
Do. 4½ % Second Deb.	100	4½	4½	100 —102	..	4 8 3
County of London, Ord.	10	6	6	11 — 11½ xd	..	5 2 10
Do. 6 % Pref.	10	6	6	11¼ — 12 xd	..	5 0 0
Do. 4½ % Deb.	Stock	4½	4½	104 —106	..	4 4 11
Do. 4½ % Second Deb.	Stock	4½	4½	99 —102	..	4 8 8
Edmundson's, Ord.	£3	Nil	..	1/16 — 1/16 xd	..	Nil
Do. 6 % Cum. Pref.	5	Nil	3	4⅛ — 4⅜	..	..
Do. 6% Non-Cum. Pref.	5	..	..	1⅜ — 1⅝	..	..
Do. 4½ % First Mort. Deb.	100	4½	4½	81 — 84	..	5 7 2
Folkestone	5	6	6	4⅝ — 5⅛	..	5 17 1
Do. 5 % Cum. Pref.	5	5	5	4⅝ — 5⅛	..	4 17 7
Do. 4½ % First Deb.	100	4½	4½	90 — 92	..	4 17 10
Hove	5	9	8†	7⅞ — 8	..	5 12 6
Kensington & Knightsbridge, Ord	5	9	8†	7½ — 8 xd	..	5 12 6
Do. 4 % Deb.	Stock	4	4	90 — 93	..	4 6 0
Kent Elec. Power, 4½ % Deb.	Stock	4½	4½	76 — 80	..	5 12 6
London Electric, Ord.	£	2½	..	1⅜ — 1⅞ xd	..	4 0 0
Do. 6 % Pref.	5	6	6	4⅛ — 5⅛ xd	+ ⅛	5 14 3
Do. 4 % First Mort. Deb.	Stock	4	4	90 — 93	..	4 6 0
Metropolitan	5	4	4†	3⅜ — 4	..	5 0 0
Do. 4½ % Cum. Pref.	5	4½	4½	4⅛ — 4⅜	..	4 17 4
Do. 4½ % First Mort. Deb.	Stock	4½	4½	97 —100	..	4 10 0
Do. 3½ % Mort. Deb.	Stock	3½	3½	84 — 86	..	4 1 5
Midland Electric Corporation 4½ % First Mort. Deb.	100	4½	4½	98 —101	..	4 9 1
Newcastle-on-Tyne 5 % Pref., Non-Cum.	5	5	5	4⅜ — 4⅞	..	5 2 7
North Metropolitan Power Supply, 5 % Mortgages (Red.)	100	5	5	99½—102½	..	4 17 7
Notting Hill, 6 % Non-Cum. Pref.	10	6	6	9⅜ — 10⅜	..	5 11 7
Oxford	5	7½	6†	5⅞ — 6⅜ xd	..	5 13 9
St. James' and Pall Mall, Ord.	5	10	10†	8⅜ — 9	..	5 11 1
Do. 7 % Pref.	5	7	7	6½ — 7½	..	4 16 7
Do. 3½ % Deb.	100	3½	3½	84 — 87	..	4 0 6
Smithfield Markets, Ord.	5	2	2	3 — 1⅜	..	..
South London, Ord.	4	5	..	3 — 3⅜	..	5 18 6
Do. 5 % First Mort. Deb.	100	5	5	97 —100	..	5 0 0
South Metropolitan, 7 % Pref.	1	7	7	1⅜ — 1⅜	..	5 14 10
Do. 4½ % First Deb. Stock	100	4½	4½	96 — 99	..	4 11 3
Urban, Ord.	£3	Nil	..	1/16 — 3/16	..	..
Do. 5 % Cum. Pref.	5	2	‡	2⅜ — 3⅛	..	..
Do. 4½ % First Mort. Deb.	100	4½	4½	85 — 88	..	5 2 3
Westminster, Ord.	5	10	10	8⅜ — 8⅞	..	5 12 8
Do. 4½ % Cum. Pref.	5	4½	4½	4⅜ — 5⅛	..	4 5 9

COLONIAL AND FOREIGN ELECTRICITY SUPPLY AND POWER.

Adelaide, 6 % Pref.	5	6	6	5 — 5½	..	5 14 8
Calcutta, Ord.	5	8½	7†	6¼ — 7	..	6 1 5
Do. 5 % Pref.	5	5	5	4⅞ — 5⅛	..	4 17 7
Calgary Power, 1st Mort. Bds.	100	5	5	92 — 94	..	5 6 5
Canadian Gen. El. Com.	$100	7	7	115 —119	..	5 17 8
Do. 7 % Pref.	$100	7	7	120 —124	..	5 18 0
Cordoba Lt., Power and T., Ord.	1	8		1/16 — 3/16	..	5 14 3
Do. 5 % Deb.	100	5	5	98 — 99	..	5 1 0
Elec. Lt. and P. of Cochabamba, 8 % Bonds	100	6	6	93 — 95	..	6 6 4
Elec. Supply Victoria, 5 % 1st Mort. Deb.	100	5	5	90 — 93	..	5 7 6
Elec. Dev. Ontario, 5 % 1st Mort. Bonds	$500	5	5	93 — 95	..	5 5 3
Kalgoorlie Elec. P. and L., Ord.	10/-	Nil	..	1/16 — 3/16	..	Nil
Do. 6 % Pref.	1	6	6	1/16 — 3/16	..	9 15 2
Kaministiquia Power, 5 % G. Bs.	$500	5	5	101¼—103½	..	4 16 7
Madras, Ord.	£	Nil	..	1⅜ — 1⅝	..	..
Melbourne, 5 % 1st Mort. Deb.	100	5	5	101 —104	..	4 16 2
Mexican El. Lt., 5 % 1st M. Bds.	..	5	5	81 — 84	..	5 19 0
Mexican Lt. & Power, Common	$100	4	4½	77 — 80	..	5 0 0
Do. 7 % Cum. Pref.	$100	7	7	100 —104	..	6 14 7
Do. 5 % 1st Mort. Gold Bds.	..	5	5	93 — 95	..	5 5 3
Monterey Rly. Light & Power, 5 % 1st Mort. Deb.	100	5	5	82 — 85	..	5 17 8
Montreal, Lt., H. and Power	$100	8	9†	225 —230	—3	3 18 3
Northern, Lt., Power and Coal, 5 % 1st Mort. Bonds	$500	5	5a	10 — 20	..	..
River Plate, Ord.	Stock	10	..	217 —227	..	4 8 0
Do. 6 % Non-Cum. Pref.	Do.	6	6	105 —110	..	5 9 1
Do. 5 % Deb. Stock	Do.	5	5	100 —102	..	4 18 0
Roy. Elec. Co., Montreal, 4½ % 1st Mort. Deb.	100	4½	4½	100 —102	..	4 8 3
Shawinigan Water, Capital	$100	5	5	138 —142	— 1	3 10 5
Do. 5 % Con. 1st Mort. Bonds	$500	5	5	107 —109	..	4 11 9
Do. 4½ % Per. Deb.	Stock	4½	4½	101 —103	..	4 7 5
Toronto Power, 4½ % Deb.	Do.	4½	4½	98½—100½	..	4 9 7
Vera Cruz Lt., P. and T., 5 % 1st Mort. Deb.	100	5	5	91 — 94	..	5 6 5
Victoria Falls Power, Pref.	1	11½d.	17½d.	13/16 — 15/16	..	..
West Kootenay Power and Lt., 1st Mort. 6 % Gold	100	6	6	106 —108	+1	5 11 1

TELEGRAPH AND TELEPHONE COMPANIES.

Amazon Telegraph	10	4	4½†	7 — 7⅞	..	6 0 0
Do. 5 % Deb. Red.	Stock	5	5	97 — 99	..	5 1 0
American Telep. & Teleg., Cap.	$100	8	8†	134 —136	..	5 17 8
Do. Collat. Trust	$1000	4	4	90 — 92	..	4 7 0
Anglo-American Telegraph	Stock	8	8	65⅞ — 67½	..	4 9 0
Do. 6 % Pref.	Do.	6	6	111 —112	..	5 7 2
Do. Def.	Do.	80/-	..	24/6 — 24½	..	6 1 7
Anglo-Portuguese Tel., 5 % Mort. Deb.	100	5	5	99½ —101½	..	4 18 6
Chili Telephone	5	7	8	7⅛ — 7⅜	+⅛	5 1 1
Commercial Cable, Stlg. 4 % Deb.	Stock	4	4	80 — 82	+ ½	4 17 7
Cuba Telegraph	10	6	6†	8½ — 9⅛	..	6 9 9
Do. 10 % Pref.	10	10	10	16 — 17	..	5 17 8
Direct Spanish Telegraph, Ord.	5	4	4†	3½ — 3⅝	..	5 6 8
Do. 10 % Cum. Pref.	5	10	10	6⅝ — 7	+ ⅛	7 2 10
Direct United States Cable	10	5	4	6½ — 7⅜	..	6 15 7
Direct W. India Cable, 4½ % Reg. Deb.	100	4½	4½	99 —101	..	4 9 0
Eastern Telegraph, Ord. Stock	Stock	7	7†	134 —137	..	5 2 2
Do. 3½ % Pref. Stock	Do.	3½	3½	78½ — 80½	..	4 6 11
Do. 4 % Mort. Deb.	Do.	4	4	96 — 98	..	4 1 8
Eastern Extension	10	7	7†	12⅞ — 13⅜	— ⅛	5 4 8
Do. 4 % Deb.	Stock	4	4	95 — 97	..	4 2 6
East and S. Africa Tel. 4 % Mt. Db. Mauritius Sub.	25	4	4	98 —101	..	3 19 8
Globe Telegraph and Trust	10	6	6†	10⅜ — 11½ xd	+4/6	5 7 10
Do. 6 % Pref.	10	6	6	12½ — 13	..	4 12 4
Great Northern Telegraph	10	18	18	29 — 31	..	5 14 8
Indo-European Telegraph	25	13	5†	58 — 60	..	5 8 4
Mackay Companies Common	100	5	5	80 — 82 xd	..	6 2 0
Do. 4 % Cum. Pref.	$100	4	4	67 — 69 xd	..	5 16 0
Marconi's Wireless Telegraph	1	20	..	4⅛ — 4⅞	+⅛	4 10 1
Do. 7 % Cum. Partic. Pref.	1	17	..	8⅜ — 8⅝	+ ⅛	4 7 10
Monte Video Telephone, Ord.	1	6	6†	1/16 — 1/16	..	5 18 0
Do. 5 % Pref.	1	5	5	1/16 — 1/16	..	5 14 8
New York Telep., 4½ % Gen. Bnds.	100	4½	4½	98 — 99	..	4 10 11
Oriental Telep. and Elec.	1	8	6†	18⅜ — 18⅞	+ 1/16	4 7 0
Do. 6 % Cum. Pref.	1	6	6	1⅜ — 1⅜	..	4 18 6
Do. 4 % Red. Deb.	Stock	4	4	88 — 90	..	4 8 11
Pacific and European Tel., 4 % Guar. Debs.	Do.	4	4	97½ — 99½	..	4 0 5
Reuter's	10	10	10†	11⅜ — 11⅝	..	8 10 2
Do. New Shares	10	..	..	10½ — 11⅛	..	..
Submarine Cables Trust	Cert.	6	6	127 —130	..	4 12 4
Telephone Co. of Egypt, 4½ % Deb. Red.	Stock	4½	4½	96 — 98	+1	4 11 10
United River Plate Telephone	5	3	..	7⅜ — 7⅝	..	5 4 11
Do. 5 % Cum. Pref.	5	5	5	5⅛ — 5⅜	+ ⅛	4 9 0
West Coast of America	2½	2½	..	1¼ — 1½	..	4 3 4
Do. 4 % Debs., 1 to 1,500 guar. by Bras. Sub. Tel.	100	4	4	96 — 98	..	4 1 8
West India and Panama Teleg.	10	2½	1½†	2⅜ — 3⅛	— ⅛	..
Do. 6 % Cum. 1st Pref.	10	6	6	10 — 10½	..	5 14 8
Do. 6 % Cum. 2nd Pref.	10	6	6	9½ — 10	..	6 0 0
Do. 5 % Debs.	100	5	5	101 —103	..	4 17 1
Western Telegraph, Ltd.	10	7	7†	18 — 18½ xd	..	5 3 8
Do. 4 % Deb.	Stock	4	4	95 — 97	..	4 2 6
Western Union 4½ % Fdg. Bonds	$1000	4½	4½	97½ —100½	..	4 10 0

*Unless otherwise stated, all shares are fully paid. a Paid in deferred interest warrants. † Interim Dividend. ‡ 8s. in Funded Dividend Certs.

CONTINUED ON NEXT PAGE.

SHARE LIST OF ELECTRICAL COMPANIES.—(*Continued.*)

ELECTRIC RAILWAYS AND TRAMWAYS.—HOME.

NAME.	Stock or Share.	Dividends for 1911.	Dividends for 1912.	Closing Quotations Mar. 15th.	Rise + or Fall —	Present Yield p.c.
	*					£ s. d.
Bath Trams, Pref. Ord.	1	Nil	Nil	⅛ — ¼	..	Nil
Do. 5 % Pref.	1	5	5	11⅝ — 11¾	..	6 8 1
Do. 4½ % Deb.	100	4½	4½	76 — 81	..	5 11 1
Brit. Elec. Trac., 6 % Pref. ..	100	..	..	10 — 12	..	..
Do. Do. Deferred ..	100	..	..	4½ — 6½	..	..
Do. Do. 6 % Cum. Pr. f.	100	6	6	85½ — 88½	..	6 15 7
Do. 7 % Non-Cum. Pr. f.	100	..	..	35 — 38	..	..
Do. 5 % Perp. Deb. ..	100	5	5	91 — 95	..	5 5 3
Do. 4½ % 2nd Deb. ..	100	4½	4½	77 — 81	..	5 7 2
Central London Railway, Ord.	100	8	8	78 — 80	..	†5 0 0
Do. Pref.	100	4	4	83 — 85	..	†4 14 2
Do. Def.	100	2	2	78 — 80	..	†5 0 0
Do. 4 % Deb.	100	4	4	98 —100	..	4 0 0
City & S. London, 6 % Pref., 1891	100	5	5	99 —102	..	4 18 0
Do. Do. 1898	100	5	5	99 —102	..	4 18 0
Do. Do. 1901	100	5	5	97 —100	..	5 0 0
Do. Do. 1908	100	5	5	95 — 98	..	5 2 0
Do. 4 % Deb.	100	4	4	97 — 99	..	4 0 10
Dublin United Trams, 6 % Pref.	10	6	6	11½ — 12¾	..	4 18 0
Great Northern & City, Pr. f. Ord	10	Nil	Nil	2⅛ — 2⅜	..	Nil
Hastings Trams, 6 % Pref. ..	1	6	6†	⅝ — ¾	..	7 7 8
Do. 4½ % Deb.	100	4½	4½	69 — 74	..	6 1 7
Isle of Thanet Trams, 5 % Pref.	5	2½	2½	2⅜ — 2⅝	..	4 15 3
Do. 4 % Deb.	100	4	4	75 — 80	..	5 0 0
Lancashire United, 5 % Deb. ..	100	5	5	73 — 80	..	6 5 0
London Elec. Railw'ys, 4 % Deb.	100	4	4	94 — 96	..	4 8 4
London United Trams, 5 % Pref.	10	Nil	..	4½ — 5	..	..
Do. 4 % Deb.	100	4	4	65 — 69	—1½	5 16 0

NAME.	Stock or Share.	Dividends for 1911.	Dividends for 1912.	Closing Quotations Mar. 15th.	Rise + or Fall —	Present Yield p.c.
	*					£ s. d.
Metropolitan Railway Consol. ..	100	1⅝	1⅝	51 — 51½	+ ½	3 3 1
Do. Surplus Lands	100	2½	2½†	61 — 63	..	4 6 0
Do. 3½ % Deb.	100	3½	3½	84 — 86	..	4 1 5
Do. 3½ % Pref.	100	3½	3½	82 — 84	..	4 3 4
Do. 3½ % Con. Pref.	100	3½	3½	81 — 83	..	4 4 4
Metropolitan District Ord. ..	100	Nil	Nil	33 — 33½	+ ½	Nil
Do. 6 % Deb.	100	6	6	135 —137	..	4 7 7
Do. 4 % Deb.	100	4	4	93 — 95	..	4 2 6
Do. 4 % Prior Lien	100	4	4	98 —100	..	3 19 8
Do. 4½ % First Pref.	100	4½	4½	85 — 87	..	5 1 2
Do. 3½ % Gtd.	100	3½	3½	75 — 77	..	4 10 11
Metropolitan Elec. Trams, Ord.	1	6	5†	1⅜ — 1½	..	5 18 6
Do. 5 % Pref.	1	5	5	1¼ — 1⅜	— ⅛	6 8 1
Do. 4½ % Deb.	100	4½	4½	89 — 92	..	4 17 10
Do. 5 % Deb.	100	5	5	94 — 97	..	5 3 1
Potteries, Ord.	1	3½	..	⅝ — ¾	..	..
Do. 5 % Pref.	1	5	5	1⅜ — 1½	..	6 19 0
Do. 4½ % Deb.	100	4½	4½	85 — 88	..	5 2 8
South Metro. Trams, 6 % Pref.	1	6	..	1¼ — 1⅜	..	7 7 8
Do. 4 % Deb.	100	4	4	65 — 70	..	5 14 4
Underground Elec. Railways	10	..	..	4⅛ — 4⅜	..	Nil
Do. "A"	1/-	..	..	⅝ — ¾	..	..
Do. 6% First Cum. Inc. Deb.	100	..	6	109 —111	..	5 9 1
Do. 4½ % Bonds	100	4½	4½	98 —100	..	4 10 0
Do. 6 % Income	100	1½	6 †	92 — 98	..	6 9 0
Yorkshire (West Riding), Ord.	5	Nil	..	⅛ — ¼	..	Nil
Do. 6 % Pref.	5	3	3½	2⅞ — 3⅛	..	4 12 4
Do. 4½ % Deb.	100	4½	4½	80 — 84	..	5 7 2

ELECTRICAL RAILWAYS AND TRAMWAYS.—COLONIAL AND FOREIGN.

Anglo-Arg. Trams, 1st Pref. ..	5	5½	5½	4⅛ — 5⅛	..	5 8 7
Do. 2nd Pref.	5	5½	5½	4⅜ — 4⅝	..	5 14 3
Do. 4 % Deb.	100	4	4	90½ — 92½	..	4 6 6
Do. 4½ % Deb.	100	4½	4½	98½ —100½	..	4 9 7
Do. 5 % Deb.	100	5	5	98 —100	..	5 0 0
Auckland Trams, 5 % Deb. ..	100	5	5	101 —103	..	4 17 1
Bombay Elec. S. & Trams, Pref.	10	6	6	11 — 11½	..	5 9 2
Do. 4½ % Deb.	100	4½	4½	96 — 98	..	4 11 10
Do. 5 % 2nd Deb.	100	5	5	97 — 99	..	5 1 0
Brazilian Traction Light and Power	$100	..	6†	97 — 99	..	..
Brisbane Trams Invt., Ord. ..	5	8	8†	7⅞ — 7⅞	..	5 5 0
Do. 5 % Pref.	5	5	5	4⅝ — 5⅛	..	4 15 8
Do. 4½ % Deb.	100	4½	4½	100 —108	..	4 7 5
B. Columbia Elec. Rly., Def. ..	100	8	..	133 —138	—1	5 16 0
Do. Pref. Ord.	100	6	6	118 —118	—1	5 1 8
Do. 5 % Pref.	100	5	5	103 —106	..	4 14 4
Do. 4½ % 1st Mort. Deb. ..	40	4½	4½	100 —103	..	4 7 5
Do. 4½ % Vancouver Deb. ..	100	4½	4½	101 —103	..	4 7 5
Do. 4½ % Con. Deb.	100	4½	4½	96 — 97 xd	..	4 7 8
Calcutta Trams, Ord.	5	7	5†	6⅛ — 6½	..	5 12 0
Do. 5 % Pref.	5	5	5	4⅛ — 5⅛	..	4 17 7
Do. 4½ % Deb.	100	4½	4½	97½ —100½	..	4 9 7
Cape Electric Trams	1	2½	..	⅜ — ½	..	..
City Buenos Aires Trams (1904)	5	5	5†	5⅛ — 5⅜	..	4 8 0
Do. 4 % Deb.	100	5	5	97 —100	..	5 0 0
Colombo Elec. Tr. & Lt., 5 % Deb.	100	5	5	98 — 97	..	5 2 1
Havana Elec. Rly., 5 % Bonds	$1000	5	5	99 —103	..	4 17 1
Kalgoorlie Elec. Trams	1	Nil	..	⅛ — ⅜	..	Nil
Do. 5 % A Deb.	100	5	5	83 — 88	..	5 13 8
Do. 6 % B Deb.	100	6	3	25 — 35	..	..
La Plata Elec. Trms, Ord. ..	1	Nil	..	⅛ — ¼	..	..
Do. Pref.	1	6	..	¾ — 1	..	6 0 0
Lisbon Elec. Trams, Ord. ..	1	6	6†	1⅜ — 1⅝	..	4 7 8
Do. 6 % Pref.	1	6	6	1 — 1¼	..	4 16 0
Do. 5 % Deb.	100	5	5	92 — 97	..	5 3 1
Madras Elec. Tr. (1904), Deb. ..	100	5	5	102 —104	..	4 16 2
Manaos Trams & Lt., 1st Deb. ..	100	5	5	87 — 90	..	5 11 1
Manila Elec. R. and Lig., Bonds	$1000	5	5	98 —100	..	5 0 0
Mexico Trams Com.	$100	7	7†	108 —111	..	6 6 2
Do. Gen. Con. 5 % Bonds ..	..	5	5	90½ — 92½	—1	5 8 1
Do. 6 % Bonds	100	6	6	95½ — 99½	—1½	6 0 7
Para Elec. Rlys. & Lt., Ord. ..	6	10	10	6⅝ — 7⅜ xd	..	6 15 7
Do. 6 % Pref.	5	6	6	4⅛ — 5⅛ xd	..	5 15 8
Do. 5 % 1st Deb.	100	5	5	99 —101	..	4 19 0
Perth (W.A.) Elec. Tr., Ord. ..	1	5	5½	1⅜ — 1½	..	3 14 5
Do. 5 % 1st. Deb.	100	5	5	105 —108	..	4 12 7
Rangoon El. Tr. & Sup., Pref. ..	5	6	6	5⅜ — 5⅝	..	5 0 0
Do. 4½ % 1st Deb.	100	4½	4½	97 — 99	..	4 10 11
Rio de Janeiro Trams, 1st Mort. 5 % Bonds	..	5	5	101 —102	..	4 18 0
Do. 5 % Mort. Bonds ..	100	5	5	96 — 97	..	5 3 1
Sao Paulo Tram, Lt. and P. 5 % 1st Deb.	$500	5	5	102 —104	— ½	4 16 2
Singapore Trams, 5 % Deb. ..	100	5	5	86 — 90	..	5 11 1
Southern El. Tr. B.A., 5 % Deb.	100	5	5	95½ — 97½	..	5 2 7
Un. Elec. Trams Monte Video ..	5	7	6†	5⅝ — 5⅞	..	6 4 5
Do. 6 % Pref.	5	6	6	4⅝ — 5⅛	..	5 11 7
Do. 5 % 1st Deb.	100	5	5	98 —101	..	4 19 0
Winnipeg Elec. Rly., 4½ % Deb.	100	4½	4½	98½—101½ xd	..	4 8 8

MANUFACTURING COMPANIES.

Aron, Ord.	1	6	..	⅜ — ½	..	8 0 0
Do. 6 % Pref.	1	6	6	5⅞ — 6⅛	..	7 2 2
Babcock & Wilcox	1	25	14†	33½ — 34½	..	4 0 0
Do. Pref.	1	6	6	1⅝ — 1⅞	..	4 0 0
British Aluminium, Ord.	1	Nil	..	⅜ — ½	..	..
Do. 6 % Cum. Pref.	1	Nil	..	⅝ — ¾	..	..
Do. 5 % Prior Lien Debs. ..	100	5	5	91 — 94	..	5 6 5
Do. Deb. Stk.	100	5	5	87 — 90	..	5 11 1
B.I. & Helsby Cables	5	15	8†	8½ — 8⅝	..	5 15 11
Do. Pref.	5	6	6	5½ — 6¼	..	4 16 0
Do. Deb.	100	4½	4½	102 —104	..	4 6 7
British Thomson-Houston, Deb.	100	4½	4½	96 — 98	..	4 11 10
British Westinghouse, Pref. ..	8	Nil	Nil	⅞ — 1⅛	..	Nil
Do. Deb.	100	4	4	58 — 61	..	5 11 2
Do. 6 % Prior Lien ..	100	6	6	100 —103	..	5 16 6
Browett, Lindley, Ord.	1	..	..	3/- — 3/6	..	Nil
Do. Pref.	1	..	..	4/6 — 5/-	..	Nil
Brush, 7 % Pref.	9	Nil	Nil	0 — ⅛	..	Nil
Do. 5 % Prior Lien Deb. ..	100	5	5	78 — 78	..	6 8 2
Do. 4½ % Deb	100	4½	4½	82 — 43	..	10 9 4
Do. 4½ % Second Deb. ..	100	4½	4½	28 — 32	..	14 1 4
Callender's Cable	5	15	10†	10⅜ — 11⅛	..	6 10 5
Do. Pref.	5	5	5	4⅜ — 5⅛	..	4 17 7
Do. Deb.	100	4½	4½	97 —100	..	4 10 0
Castner-Kellner	1	20	20	33½ — 34⅝	..	5 5 10
Do. Deb.	100	4½	4½	103 —106	..	4 4 11
Crompton & Co.	3	Nil	..	⅛ — ⅜	..	Nil
Do. Deb.	100	5	5	55 — 57	..	9 15 6
Dick, Kerr	1	5	Nil	½ — ¾	..	..
Do. Pref.	1	6	6	1¼ — 1⅜	..	7 7 8
Do. Deb.	100	4½	4½	95 — 98	..	4 11 10
Edison & Swan, A, £3 paid	5	Nil	..	⅛ — ¼	..	Nil
Do. fully paid	5	Nil	..	1½ — 1⅝	..	Nil
Do. 4 % Deb.	100	4	4	61 — 65	..	6 3 1
Do. 5 % Second Deb.	100	5	5	73 — 76	..	6 13 4
Electric Construction	2	2½	3⅜	1⅝ — 1⅞	..	5 14 4
Do. Pref.	2	7	7	1¾ — 2	..	7 0 0
Greenwood & Batley, Pref. ..	10	7	7	7½ — 8	..	8 5 8
Do. Deb.	100	5	5	92 — 94	..	5 4 3
General Electric, Pref.	10	5	5	10 — 10½	..	4 13 0
Do. Deb.	100	4	4	90 — 95	..	4 4 8
Henley's, Ord.	5	15	15	12½ — 13 xd	— ½	5 15 5
Do. Pref.	5	4½	4½	4⅝ — 5⅛ xd	+ ⅛	4 7 10
Do. Deb.	100	4½	4½	101 —103	..	4 7 5
India-Rubber, G. & T.	10	..	7½	10 — 11	..	6 16 4
Do. Pref.	10	5	5	9 — 10	..	5 0 0
Telegraph Construction	12	17½	17½	84 — 86 xd	..	5 16 8
Do. Deb.	100	4	4	95½ — 98½	..	4 1 3
Willans & Robinson	1	Nil	..	⅛ — ¼	..	Nil
Do. Pref.	5	Nil	..	⅛ — ¼	..	Nil
Do. Deb.	100	4	4	57 — 59	..	6 15 7

* Unless otherwise stated, all shares are fully paid. † Interim dividend. ‡ Dividend of 4 per cent. guaranteed by Underground Electric Railways.

Bank rate of Discount 5 per cent., October 17th, 1912.

TRADE STATISTICS OF HOLLAND.

The following figures, showing the imports of various goods into Holland in 1911, are taken from the recently issued annual trade statistics; the figures for 1910 are added for purposes of comparison, and notes of any increases or decreases are given:—

	1910.	1911.	Inc. or dec.
	Gulden.	*Gulden.*	*Gulden.*
Machinery, steam, industrial and agricultural.—			
From Belgium	2,487,000	2,400,000	— 87,000
„ Great Britain ...	5,779,000	8,192,000	+ 2,413,000
„ Hamburg	117,000	153,000	+ 36,000
„ Germany	15,468,000	17,714,000	+ 2,246,000
„ United States ...	2,747,000	3,292,000	+ 545,000
„ Other countries ...	297,000	378,000	+ 81,000
Total ...	26,895,000	32,129,000	+ 5,234,000
Gutta-percha, raw.—			
From France	103,000	300,000	+ 197,000
„ Great Britain ...	202,000	127,000	— 75,000
„ Dutch Guiana ...	655,000	603,000	— 52,000
„ Java...	5,077,000	4,073,000	— 1,004,000
„ Other countries ...	410,000	272,000	— 138,000
Total ...	6,447,000	5,375,000	— 1,072,000
Gutta-percha manufactures.—			
From Belgium	477,000	459,000	— 18,000
„ Great Britain ...	515,000	226,000	— 289,000
„ Germany	608,000	455,000	— 153,000
„ Other countries ...	156,000	1,000	— 155,000
Total ...	1,756,000	1,141,000	— 615,000
Iron wire.—			
From Belgium	3,197,000	3,793,000	+ 596,000
„ Great Britain ...	25,000	67,000	+ 42,000
„ Germany	20,279,000	23,116,000	+ 2,837,000
„ Sweden	166,000	288,000	+ 122,000
„ Other countries ...	52,000	9,000	— 43,000
Total ...	23,719,000	27,273,000	+ 3,554,000
Instruments, physical, chemical, &c.—			
From Belgium	532,000	692,000	+ 160,000
„ Great Britain ...	484,000	515,000	+ 31,000
„ Hamburg	39,000	132,000	+ 93,000
„ Germany	4,554,000	5,106,000	+ 552,000
„ Other countries ...	99,000	242,000	+ 143,000
Total ...	5,708,000	6,687,000	+ 979,000
Copper wire.—			
From Belgium	123,000	174,000	+ 51,000
„ Great Britain ...	96,000	109,000	+ 13,000
„ Hamburg	154,000	9,000	— 145,000
„ Germany	2,494,000	3,074,000	+ 580,000
„ Other countries ...	68,000	279,000	+ 211,000
Total ...	2,935,000	3,645,000	+ 710,000
Steel wire.—			
From Belgium	446,000	589,000	+ 143,000
„ Great Britain ...	644,000	950,000	+ 306,000
„ Germany	1,595,000	1,067,000	— 528,000
„ Other countries ...	21,000	2,000	— 19,000
Total ...	2,706,000	2,608,000	— 98,000
India-rubber manufactures.—			
From Belgium	238,000	546,000	+ 308,000
„ Great Britain ...	2,083,000	2,261,000	+ 178,000
„ Germany	1,981,000	2,446,000	+ 465,000
„ United States ...	20,000	19,000	— 1,000
„ Other countries ...	70,000	196,000	+ 126,000
Total ...	4,392,000	5,468,000	+ 1,076,000
Glass manufactures.—			
From Belgium	271,000	279,000	+ 8,000
„ Great Britain ...	103,000	99,000	— 4,000
„ Germany	1,902,000	1,908,000	+ 6,000
„ Other countries ...	13,000	40,000	+ 27,000
Total ...	2,289,000	2,326,000	+ 37,000
Porcelain.—			
From Belgium	151,000	174,000	+ 23,000
„ Great Britain ...	48,000	56,000	+ 8,000
„ Germany	1,104,000	1,312,000	+ 208,000
„ Other countries ...	49,000	44,000	— 5,000
Total ...	1,352,000	1,586,000	+ 234,000

Note: Gulden = 1s. 8d.

RELATIVE EFFICIENCY AND ADVANTAGES OF DIRECT, SEMI-DIRECT AND INDIRECT LIGHTING.

By L. CROUCH.

Illumination received from any lighting source can be regarded as due to direct and indirect components; "direct" lighting proceeds from the source to the illuminated plane, with or without diffusion by an opalescent screen, but without that complete screening of the source itself and reflection of light from a ceiling, wall, or special diffusing reflector, which characterises "indirect" lighting. In the majority of lighting schemes, the illumination provided has both direct and indirect components, and, as shown below, this condition is generally to be desired.

Some years ago, when illuminating engineering was no more than a name, the endeavour of most lighting "experts" was to increase the luminous efficiency of their lighting schemes by increasing the direct component of the total illumination. Owing to the considerable absorption of light by the diffuse reflecting surfaces, indirect lighting is naturally less efficient than direct lighting which, if secured by high-grade silvered reflectors, or, better still, prismatic reflectors, renders practically the whole of the luminous radiations from the source available in a more or less restricted field, whence a certain illumination of adjacent areas is effected (but in a manner which cannot be subjected to predetermination), by diffuse reflection. However, the low efficiency of indirect lighting is justified in many cases by the uniformity of illumination obtained. In a room lighted entirely by indirect illumination, there are practically no specular or regular reflection on working surfaces, no deep and sharply defined shadows, and no surfaces of sufficiently high intrinsic brilliancy to fatigue the eye. In such places as drawing offices, these characteristics are wholly advantageous, but in general offices, and, to a greater extent, in residences, &c., some shadow is very desirable to allow of a rational appreciation of relief and perspective. Once its novelty has worn off, purely indirect illumination becomes wearisome, depressing, and even fatiguing to the eye by its very uniformity. The tiresomeness of purely indirect illumination is particularly noticeable when the walls are of light-coloured material; much more pleasing effects are secured by the choice of a dark wall covering, and the luminous efficiency thereby sacrificed is, to some extent, compensated by keener visual acuity. The overall luminous efficiency of indirect lighting may be as low as 10 per cent. (particularly if the light fittings and ceiling, or other diffusing surface, be dirty or coloured); in very few cases can a higher luminous efficiency than 40 per cent. be secured.

There is now a general appreciation of the fact that interior illumination is usually best effected by semi-direct lighting; good diffusion and a reasonable minimum illumination should be provided by indirect light, but "life" should be given to the net illumination by a direct-lighting component arranged so as to secure faint shadows, but definite shading,* while completely avoiding glare. So much biased matter has lately appeared concerning the relative advantages of various lighting systems, that it is refreshing to study the results of a series of tests† undertaken to determine the actual merits of direct and indirect illumination and the percentages of each which should be combined in a semi-direct illuminating scheme.

By proper design, including the judicious proportioning of direct and indirect illumination, the undoubted advantages of indirect lighting can be secured while correcting its disadvantages to a great extent, by direct lighting. The efficiency of

* A striking example of the dangers of too uniform illumination is to be found on the library staircases in the Institution of Electrical Engineers' Building, Victoria Embankment, London. The ceilings are white, and the walls and stairs are surfaced with white marble, and, as a result of the almost perfect diffusion of light, it is quite difficult at night to distinguish the edges of the steps when the latter are clean.

† Further particulars of these tests are to be found in the *Southern Electrician* for December, 1912, whence the subjoined data are drawn.

indirect lighting itself must always be low, but the overall efficiency of illumination may be increased by increasing the proportion of direct lighting, so long as the desirable features of the indirect lighting are not thereby sacrificed. The inefficiency of indirect lighting does not detract from its illuminating advantages; it merely increases the cost of securing the latter.

The problems to be solved are: (1) To what extent is diffusion of light desirable, as determined by the avoidance of specular reflection and by the depth and sharpness of shadows; (2) what is the maximum intrinsic brilliancy to which the eye should be exposed; (3) what percentage of direct illumination will compensate the "flatness" of indirect lighting without introducing undesirable features?

The diffusion of the net illumination provided should be such that no appreciable direct reflection or glare is noticeable from the highly glazed paper now so frequently employed —particularly for the printing of half-tone blocks. This consideration requires that direct illumination should be provided by opalescent bowls sufficiently large to avoid specular reflection and of no greater intrinsic brilliancy than the ceiling (or other diffuse reflector) area of maximum brilliancy. Great accuracy in determining these conditions and in estimating the percentage of direct illumination is not necessary —indeed, it is impracticable.

Tests undertaken by Sweet and Doane with semi-direct lighting units showed that, in a particular case, the proportions of illumination received directly and indirectly with white ceiling and white, medium and dark walls respectively, were:—11 per cent. and 89 per cent.; 13 per cent. and 87 per cent.: 14 per cent. and 86 per cent. If the direct component of the illumination does not exceed 12 per cent. of the total, no trouble should be experienced by specular reflection, and the amount of direct illumination should be kept as near as possible to the upper limit thus determined, in order that the overall efficiency of lighting may be a maximum.

It is desirable that no sharp shadows of greater density than 15 per cent. should be present on working surfaces; for drawing office work, 10 per cent. is a better limit, and in very few cases can a 30 per cent. shadow be tolerated. The lower limit of shadow desirable is determined by considerations of perspective and relief. As regards intrinsic brilliancy, the sources of direct illumination should be no more intense than the brightest patches on the ceiling, and even the latter are sometimes brighter than is desirable for eye-protection.

Summarising, we may say that the direct illumination should be: (1) About 12 per cent. of the total from the standpoints of specular reflection and intrinsic brilliancy; (2) from 10 per cent. to 15 per cent. of the total for best shadow results.

If the percentage of direct illumination falls below 10 per cent., there will be loss of perspective and lack of "life" in the illumination, while if it much exceeds 15 per cent. of the total, the advantages of the remaining indirect illumination will hardly justify the cost of its provision. In this connection, the illuminating problem reduces to a determination of the money value to be attached to the more perfect diffusion which can be secured by indirect, as compared with direct, lighting; in picture galleries and drawing offices, &c., this value is high, but in other instances it is negligible. In any case, a well-designed direct-lighting scheme is preferable to a semi-direct system, in which the direct component is sufficiently great to reduce seriously the illuminating advantages of the indirect component.

Comparative Efficiencies.—As the average result of a large number of tests, it may be taken that two lumens can be obtained per watt expended in an indirect lighting equipment under favourable conditions. In small rooms with light walls and ceilings, the efficiency may rise to 2·5 lumens per watt, falling to 1·5 lumens per watt, or less, in large rooms with high ceilings. Definite test data which, apart from their intrinsic interest, show the comparatively high efficiency which can be obtained in indirect and semi-direct lighting systems under favourable conditions, were recently presented by Henninger and are reproduced in abstract in Table I (see also *loc. cit.*).

In Case II, tests with the lighting unit at various distances below the ceiling gave the following results:—

Hanging height below ceiling.	1 ft.	1 ft. 6 in.	2 ft.	3 ft.
Extreme per cent. var. illumn.				
Above mean	21·5	19·3	22·7	21·4
Below mean	22·0	21·1	20·2	17·6
Effective lumens per watt...	2·65	2·90	2·69	2·66

Tungsten lamps in prismatic glassware were used in Case IV; the direct illumination measurements were made with the fittings hung in their normal position, after which they were inverted, but kept at the same height as before. Finally, the inverted reflectors were surrounded by a cone of blackened Bristol board in order to isolate and determine the true indirect component of the total lighting. The maximum variation in the illumination was 55 per cent. in the direct lighting scheme, 44 per cent. in the semi-direct arrangement, and 78 per cent. under the total indirect illumination.

Efficiency considerations undoubtedly favour semi-direct as compared with indirect lighting and, if anything, a higher actual effective illumination is required in the latter case to produce the same impression of good lighting and the same ability to see well.

TABLE I.—Test Data Comparing Efficiency of Direct, Semi-Direct and Indirect Lighting.

Case.	Size of room. Length × width × height.	Walls.	Ceilings.	Lamps (Tungsten) globes, &c.	Direct, semi-direct, or indirect.	Average foot candles.	Watts per sq. ft.	Effective lumens per watt.	Relative per cent. efficiency*
I.	19 ft. × 39 ft. 7 in. × 12 ft. 2 in.	Light yellow	White	Eight 150-w. clear lamps	Direct,	6·39	—	4	100
					indirect	2·77	—	1·73	43·3
				Eight 150-w. bowl frosted	Direct,	5·63	—	3·52	88
					indirect	2·40	—	1·51	37·7
II.	9 ft. 10 in. × 8 ft. × 8 ft. 3 in.	Black White	White White	Lamp 12 in. from ceiling.	Indirect	—	—	1·66 2·43	—
III.	36 ft. × 18 ft. × 12 ft. 6 in.	36 ft. white marble wainscot and 4 ft. mirrors	Light Buff	Three 4 × 100-w. fittings.	Semi-direct	5·78	1·875	3·08	—
IV.	18 ft. 10 in. × 23 ft. × 13 ft. 10 in.	Natural wood	White	Prismatic glassware.	Direct,	—	—	3·04	100
					semi-direct,	—	—	1·54	50·6
					indirect	—	—	1·03	33·75
V.	38 ft. × 20 ft. × 10 ft.	Light yellow	Cream	Six 150-w. lamps in light opal bowls. Shade rims 15 in. below ceiling.	Semi-direct	4·14	1·16	3·56	—

* Based on clear lamps and direct illumination.

Electrical Congress in Russia.—A Russian General Electrotechnical Congress has just been held in Moscow, when among the papers read was one by M. Pilkevitch on "Central Generating Stations," in which he advocated the erection of the generating plants near the source of the fuel supply, and the transmission of the current to the point of distribution in preference to locating the station in the town to be supplied, and conveying the fuel thereto.

M. Kolivanoff, the director of the Moscow Urban Railway, submitted a scheme to the Congress for the construction of an underground electric railway in Moscow.

A resolution was adopted by the Congress in favour of a law with regard to electrical units in Russia, while it was decided to recommend the Government to enforce the adoption of officially-approved electricity meters.

THE NATIONAL INSURANCE ACT, 1911.

Courts of Referees.

By JOS. J. H. STANSFIELD, F.C.I.S.

The National Insurance Act, 1911, came into force in July, 1912, but it was provided by Sec. 84 that unemployment benefit was not to be paid in respect of any period of unemployment occurring during the first six months. This period has now expired, and as claims for benefit are being made, it becomes advisable to consider the conditions under which benefits are payable, and in what way employers are affected or interested.

The statutory requirements and conditions under which benefits are payable are set out in full in Secs. 84 to 86, but it may be shortly stated that, subject to contributions having been paid by an employer on behalf of a workman and of himself, every workman of 17 and upwards, so long as the conditions are fulfilled and the workman is not disqualified, is entitled to benefits if he has been employed in an insured trade and is unemployed.

The workman must prove (1) that he has been employed in an insured trade in each of not less than 26 weeks during the preceding five years; (2) that he has applied in the prescribed manner; (3) that since the date of application he has been continuously unemployed; (4) that he is capable of work, but unable to obtain suitable employment; and (5) that he has not exhausted his right to benefit.

The disqualifications for benefit are by Sec. 87 (1) unemployment through trade disputes, so long as the dispute lasts, unless the workman has become employed elsewhere in an insured trade (2) for six weeks from the date of leaving if the unemployment is caused through misconduct, or voluntarily leaving without just cause; (3) being an inmate of any prison or workhouse, or other institution supported wholly, or partly, out of public funds; (4) residence temporarily or permanently outside the United Kingdom; and (5) in receipt of sickness or disablement benefit, or disablement allowance, under the Health provisions of the Act.

The unemployment provisions of the Act apply to persons of 16 years and over, but no benefit is payable for unemployment occurring before the age of 17, and only half benefits are allowed from 17 to 18, but after the age of 18 the benefit is 7s. per week for each five weeks' contributions.

A consideration of the qualifications and disqualifications for benefit will show that these are partly questions of fact and partly of opinion, and as it was anticipated that there might be disputes between a workman and the Insurance Officer as to the amount of benefit due, or whether benefit is payable or not, the Act provides (Sec. 88) for the setting up of Courts of Referees to which such disputes may be referred.

The United Kingdom has been divided provisionally into eight divisions, again sub-divided into 82 districts for each of which a panel of employers' and workmen's representatives have been constituted, the names of the divisions and the number of districts in each division being as follows:—London and South-Eastern (14), South-Western (7), West Midlands (6), Yorkshire and East Midlands (13), North-Western (14), Wales (5), Scotland and Northern (19), and Ireland (4). For these 3,158 representatives have been elected, one-half on behalf of employers and the other on behalf of workmen.

The members of employers' panels have been elected by the Board of Trade, and the members of the workmen's panels by ballot of workmen engaged in insured trades. If an Insurance officer refuses or stops benefit, or allows benefit of an amount not in accordance with the claim, the workman may require the case to be referred to a Court of Referees consisting of three persons—one drawn by rota from each of the two panels, with an impartial chairman appointed by the Board of Trade, the latter being neither an employer nor a workman in an insured trade.

Should the Court of Referees make a recommendation in agreement with the decision of the Insurance Officer, its recommendation is final, but if the Court disagrees the officer must either accept the recommendation or, if desired by the Court, refer the matter to the umpire appointed by the Crown under the Act, his decision being final.

If an Insurance Officer thinks fit, he may refer a case direct to the Court, instead of deciding it himself when the decision of the Court is final.

Where a workman has required an Insurance Officer to refer his claim to a Court of Referees, the Chairman of the Court may at any time before the matter has been taken into consideration by the Court, refer it for report to two persons residing in the same neighbourhood as the workman, one of these persons being drawn from the employers' panel, and the other from that of the workmen.

Questions bearing upon the administration of Unemployment Insurance, may be referred by the Board of Trade for consideration and advice to the persons constituting the panels when special meetings will be held.

Courts of Referees usually meet weekly in some central town, but the number of representatives on the panels is sufficiently large as not usually to require an attendance of any individual member more than once a quarter.

It is as yet too early to say how Courts of Referees will succeed in settling disputes to the satisfaction of all concerned, but it is likely that some difficulty may be found in respect of the disqualification for six weeks of benefit where a workman leaves employment through misconduct or without sufficient cause. Indeed, Trade Unions already threaten agitation with regard to this, on the ground that workmen are being deprived of benefit where the misconduct has been due to a conflict between the rules of a Trade Union and the regulations of an employer.

Although employers are only indirectly concerned in the question whether a workman is entitled to benefit or not, it should not be overlooked that economical administration of unemployment benefit funds is of importance, and that, although the unemployment part of the Insurance Act at present only applies to a limited number of trades, that number may at any time be extended, within limits, by the Board of Trade, and if this part of the Act is considered to be a success, it is not unlikely that extensions may take place from time to time.

PROCEEDINGS OF INSTITUTIONS.

Electric Resistance Welding.

By P. Bucher.

(*Abstract of paper read before the* Institution of Electrical Engineers, *at Manchester, December 17th*, 1912.)

If the correct interpretation of welding signifies the joining of two pieces together so as to form one while hot under pressure, then the only one of the new methods which can rightly be classified under this head is the electric resistance welding. In every one of the other methods the metals are actually heated to melting-point, and are in reality fused together.

The provision of the necessary current is one of the greatest difficulties with which the introduction of electric welding has to contend, where there are no public mains supplying single-phase alternating current. Where the public supply is direct current, it becomes necessary to install either a motor-generator or a rotary converter for generating single-phase alternating current.

In three-phase systems it is sometimes permissible to put a welder in one phase only, but in the case of larger welders the unbalancing effect would be too serious, and means must be provided to transform three-phase into single-phase current. This can be done by a three-phase motor driving a single-phase generator. A rotary transformer with two distinct stator windings, which gives a load on the three-phase primary balanced to within about 90 per cent., is considerably cheaper than the motor-generator.

The current is transformed down to about 2 volts in a special transformer, which in almost every case forms part of the welding machine itself. The secondary winding takes the form of a copper casting corresponding to a single turn, fitted with suitable means for transmitting the current to the pieces which are to be welded.

All the parts which are exposed carry only the low-voltage secondary current, so that the process is absolutely free from danger through shock. It is important that the secondary circuit be kept as short as possible.

The method of working is, in all cases, the same. The pieces to be joined are gripped in the clamps or placed between the electrodes and brought into contact. The primary circuit is closed either by an independent act of the attendant or automatically by the machine. The heavy current flowing through the joint heats it up at once, and welding temperature is reached very rapidly, in a

fraction of a second in light wire or the spot-welding of thin sheets, or in several minutes in the case of a heavy tire. The flow of current is interrupted as soon as the required heat is reached, and therein lies one of the advantages of resistance welding—it never consumes energy unless it produces work. Simultaneously with the interruption of current and the cessation of the heating comes the upsetting or shutting of the weld by continuing or increasing the mechanical pressure which was first used to bring the two parts into contact. The application of this pressure in butt welding raises at the joint a lump or burr, which generally must be got rid of.

Somewhat similar conditions to the raising of the burr in butt-welding prevail in spot-welding. When the current passes from electrode to electrode it brings a cylinder of metal to white heat, and thereby into the plastic state. This soft cylinder is surrounded by a shell of cold and hard metal. When end-pressure is applied to it for making the weld, its volume is reduced by the amount to which the electrodes enter into it. Some of the surplus metal escapes round the circumference along the sides of the cone of the electrodes, forming a low ridge, but some of it—and this is a drawback to spot-welding—is extruded between the two sheets to be joined, slightly driving them apart. This means that spot-welding cannot be relied upon to make a water or gas-tight joint between two sheets. If that type of joint is required, the cone-shaped electrode of the spot-welder must be replaced by the roller of the seam-welder. The principle of its working is simply a repetition of spot-welding, but its result is an uninterrupted seam or lap weld.

The use of very heavy currents makes the necessary machinery heavy, cumbersome, and expensive. The field is therefore not jobbing, where arc and hot-flame welding reign supreme, but repetition work, where it scores immensely by virtue of its simplicity, accuracy, reliability, speed, and economy.

Chain links are welded at an average rate of 10 to 15 per minute, or 30 to 40,000 per week. An average week's output of a heavy tire-welder was 525 tires, varying in width from 2 in. to 9 in. A bank of spot-welders worked by boys on miscellaneous hollowware dealt with 120 to 180 gross of articles per machine, corresponding to about 35,000 welds per machine per week.

The heat efficiency of a welder is about 75 per cent. The above-mentioned weekly output of chain, assuming about 3 s.w. gauge, would use from 100 to 130 units. The tire-welder already referred to used, according to the supply company's meter, 737 units, and a spot-welder on miscellaneous hollow-ware uses about 1 to 1·5 units for 1,000 welds.

The most important question is: How strong is an electric weld? The reply to this is very favourable. Actual figures were quoted in "Experiments on the strength and fatigue properties of welded joints in iron and steel," a paper read before the Institution of Civil Engineers by Messrs. Stanton and Pannell. These experiments were made on sample welds prepared by 16 different engineering firms in the kingdom according to their usual practice. The condensed result for tensile strength is expressed in percentage of the tensile strength of the unwelded material:—

	Hand-welded iron.	Hand-welded steel.	Electric-welded iron.	Electric-welded steel.
Mean of 24 tests	21 tests	7 tests	8 tests	
	89·3	81·6	89·2	93·4

In the same way for fatigue properties:—

	Hand-welded iron.	Hand-welded steel.	Electric-welded iron.	Electric-welded steel.
Mean of 21 tests	28 tests	5 tests	12 tests	
	97·6	78·4	92·6	87·0

The authors state that with reference to the respective merits of hand and electrical welding, the tests show that more uniform results are obtained by the electrical welding method; and there appears to be no evidence that the want of uniformity in the material, which is usual in the region of a welded joint, is liable to cause failure of the joint under repeated applications of the load, provided the weld be originally sound.

Electric welders are in daily extended use in brass and copper wire mills for joining up rods and slottings, which afterwards pass through the drawing dies.

High-carbon steel can be welded up to about 0·8 per cent. carbon, but the results are not so satisfactory as in mild steel. When high-carbon wire is welded the heat of the weld is a very short one, and the bulk of the adjoining cold metal seems to have a quenching effect on the steel, so that the wire when taken from the machine is glass-hard at the joint and snaps on the slightest effort. To overcome this the wire must be locally annealed—for preference in the welder itself—and this heat treatment weakens the wire for the length to which it has been applied as compared with the rest of it.

Generally speaking, the strength of a welded high-carbon wire is about 60 to 70 per cent. of the unwelded wire.

Pure copper welds quite satisfactorily, and so do most of the brasses unless the percentage of zinc in them is too high, when the weld becomes brittle and will not draw. Nickel and most of its alloys also weld very well; so do aluminium, silver, gold, platinum and iridium.

Only iron and mild steel lend themselves to spot-welding in a satisfactory manner.

Discussion.

Prof. E. W. Marchant said he had recently made experiments on the actual amount of energy used in making electric resistance welds between samples of iron wire. The energy consumption was remarkably small, as was seen from the fact that a weld between a pair of $\frac{1}{4}$-in. rods took 20 watt-minutes, or, in other words, 1,000 welds of this kind could be made with only $\frac{1}{4}$ B.T.U. of energy. Similarly, with $\frac{5}{16}$-in. diameter rods, the energy consumption was 50 watt-minutes; $\frac{1}{2}$-in. rods, 110 watt-minutes; $\frac{5}{8}$-in. rods, 180 watt-minutes. As the diameter of the rod increased, the energy consumption per weld went up very rapidly; for example, comparing $\frac{3}{32}$-in. and $\frac{5}{16}$-in. rods, nine times as much energy per weld was required in the latter case. This increase was due partly to the increased contact area and also to the large amount of cooling due to the jaws holding the metal. The current used in the case of the $\frac{5}{16}$-in. rods was about 2,000 amperes. Using copper rods, a current of 6,000 amperes was required, against 2,000 amperes for iron of the same diameter. The use of chokers to increase and diminish the welding current would considerably increase the energy consumption in welding, but, in any case, the current rushes in welders would not seriously affect pressure regulation in the average supply station, even if no regulating device were employed.

Mr. A. E. McKenzie said that, about 2½ years ago, it was decided to increase the capacity of some superheaters, and the question of installing new superheater tubes was considered. The price of new tubes was so high that it was decided to lengthen the existing tubes by welding additional lengths. Twelve sample tubes (six scarf and six butt joints) were welded by the electrical resistance method, and on test the butt joints were found to be superior to the scarf joints, notwithstanding the greater surface of the latter. The result of the test justified the alteration of one boiler containing 40 tubes, which, after welding, were tested at 1,000 lb. per sq. in. Six months' satisfactory working of the experimental boiler warranted the change of three others, and, notwithstanding the strong criticism of the boiler makers and insurance companies, after two and a half years' work, not a single tube had given any trouble. Before making the welds, the tubes were slightly bevelled inside and outside at the butt; the burr was thrown up on the outside, although scarcely noticeable.

Mr. W. Cramp said the process of resistance welding appeared to be better than anything arc welding could produce. The portability of oxy-acetylene or oxy-hydrogen welding appliances was a great point, and, notwithstanding the author's suggestions, a direct-current machine should have a wide scope. Instead of a motor-transformer, a cheap form of homopolar machine run at a high speed might be successfully employed. If, using the same values of current and time, joints were made by (1) direct current, and (2) alternating current, would there be any difference in the results? The energy required for welding different sections of wire would depend very much upon the heat capacity of the section, and this effect would undoubtedly account for a portion of the increased energy consumption referred to by Dr. Marchant.

Mr. K. M. Faye-Hansen said that in some cases the secondary of the transformer consisted of more than one turn, also some firms used copper laminations instead of a copper casting. Electrically, the casting was as good as the laminations, and it certainly provided a much better mechanical job.

Mr. R. G. Cunliffe gave a description of a rail welding process for use on traction rails exceeding 10 sq. in. in cross-section. In this system, six special bridging plates were electrically welded so as to connect each fish-plate to the rails efficiently. The Chicago Railroad Co. employed the system with much success.

Mr. J. Frith wished to know whether in using the author's apparatus the back portion of the chain link did not short-circuit the portion to be welded. No mention had been made of the constant-current welding machine due to Dr. Rosenberg.

Dr. E. Rosenberg asked for further figures in connection with the tensile strength values. There was very little difference in the various methods according to the average value, but it was of considerable importance to know what the lowest value was.

Mr. W. Pollard Digby (communicated) said there was too much of a tendency to regard the tensile test as everything in regard to welding. They ought to consider other properties. The change in the microstructure of the metal welded was all-important. The mechanical engineer had failed to have recourse to the metallurgist. Each weld showed under the microscope such characteristics that it was possible for the metallurgist to say from a sample of the steel what method of welding had been employed. One thing was essential to resistance welds, that the resistance weld should receive adequate working while the metal was still plastic. If this were not done, one found, on cutting up a large bar welded by the resistance method, two distinct classes of fractures. The outer metal, near the extruded portion, had a decidedly splintered fracture; the inner area had a decidedly crystalline fracture with relatively low elongation, and showed under the microscope a slight tendency to overheating. Another property common to all welds in a greater or less degree was that of oxidation. Resistance welds shared with acetylene welds the least susceptibility to this. All the arc welds, on the other hand, which had come through his hands, had shown a marked tendency to oxidation. Each welding process had its own field of application. Many welding processes, not least among them that described by the author, were of great commercial success and general utility. At the same time they must really cease to place this excessive emphasis on tensile strength, and consider instead the fact that while tensile strength might remain high, the other mechanical properties might be affected, and not least, corrosion might be facilitated.

Mr. L. W. Schuster (communicated) said that the most interesting feature of the subject dealt with in the paper was the effect on the metal due to the welding. In the case of the acetylene welding of cracks and grooving of boiler plates, local hardening of the metal appeared to take place; great difficulty was encountered in obtaining a satisfactory weld, and the cracks were always liable to extend. It would appear that this would equally be the case in the event of its being practicable to adapt electric welding for repair

work of this nature. The cutting of plates by the acetylene blow-pipe flame seemed to have the same hardening effect, although in the case of steel pipes being cut in this manner for receiving branches and the branches being afterwards welded by the acetylene process on to the pipes, the results appeared to be satisfactory, but it might perhaps be safer to anneal afterwards. In the case of the electrical welding of flanges to pipes, the results did not appear to have come up to expectation.

The AUTHOR, in reply, said that aluminium welds were extensively made in connection with rim work in the Birmingham district. Regarding the chain link question, a certain amount of current did go round the back of the link, but not enough to make it unbearably hot to the fingers; even in small links the economy of the process was so pronounced that this loss of energy was never considered of importance. Some firms used copper stampings for the secondary, but by far the majority used a copper casting.

The Institute of Metals.

THE annual general meeting of the Institute of Metals was held in London on March 11th, when the new president delivered his inaugural address. On the following day a number of papers were read. One on "Metal-Filament Lamps," contributed by Mr. Alexander Siemens, summarises the history of the use of metal filaments in glow lamps, and states that the first lamp to have actually drawn-metal wire as its filament was the tantalum lamp, manufactured by Siemens & Halske, Berlin. They also succeeded in drawing an alloy of tungsten and nickel, but before that process was perfected, the General Electric Co., of Schenectady, patented a process to make pure tungsten ductile, which is described in the paper.

Mr. Arnold Philip (Admiralty Chemist) dealt with "The Corrosion of Distilling Condenser Tubes."

A paper by Dr. G. H. Bailey deals with the action of water and salt solutions on aluminium. From an examination of the experimental evidence, he draws the following conclusions:—That aluminium of high purity is less readily acted upon that of lower purity, and that the presence of sodium and copper in the metal increases the rapidity of corrosion. Well-annealed metal is also more resistant to corrosion than unannealed metal. In general the corrosion of aluminium is a process of oxidation; metal exposed for several months to water or salt solutions from which the dissolved air had been expelled, underwent no corrosion whatever. The normal course of corrosion (excluding the action of acids and alkalis) is thus a transformation of aluminium into alumina, which separates out as a flocculent precipitate without any of the aluminium passing into solution.

Mr. O. F. Hudson discussed the microstructure of German silver, and Mr. G. H. Gulliver read a paper on "The Quantitative Effect of Rapid Cooling upon the Constitution of Binary Alloys." The importance of the subject is due to the fact that the constitution of a cast alloy cooled at ordinary rates lies between that of the very slowly-cooled and that of the very quickly-cooled mixture, so that its limits of variation with change in the rate of cooling can now be specified.

A paper was read by Messrs. H. S. Primrose and J. S. Glen Primrose, on "Practical Heat Treatment of Admiralty Gun-metal." They find that even in the absence of blow-holes, which constitute the commonest source of unsoundness, cast gun-metal behaves unsatisfactorily under hydraulic tests due to the presence of microscopical pores formed between two constituents of widely-different properties. The most marked improvement was found to be produced by annealing the bars for half-an-hour at a temperature of 700° C., as the physical tests showed lower results both above and below this critical point.

The report of Council showed that the membership amounted to 614, an increase of 28. The balance to the credit of the Institute at June 30th, 1912, was £548, in addition to the balance in the research fund and various minor assets.

Recent Developments in the Street Lighting of Manchester.

By S. L. PEARCE, M.I.E.E., and H. A. RATCLIFF, M.I.E.E.

(Abstract of paper read before the INSTITUTION OF ELECTRICAL ENGINEERS, *at Manchester, February 25th, and London, March 6th, 1913.)*

THIS paper is principally a record of the work undertaken, the results obtained, and the numerous tests and experiments upon which the satisfactory completion of the work depended.

The first installation of arc lighting in Manchester was carried out in the early part of 1897. A number of 500-watt "open-type" arc lamps of the short-hour double-carbon type, suspended about 22 ft. above the ground, were erected. On October 27th, 1897, the City Council approved a report of the Electricity Committee recommending that all tramway routes be lighted by arc lamps; and in the following year application was made to the Local Government Board, and sanction subsequently received, for the borrowing of £75,000 for street-lighting purposes. The work has not been carried out, though at one period it was the distinct desire of the Corporation that the main thoroughfares should be so illuminated.

In 1904, the original "open-type" arcs were superseded by 600-watt and 900-watt lamps of the single-enclosure type, suspended some 18 ft. 6 in. from the ground, and burning 100 hours without re-trimming.

At or about that time a limited number of intensified gas lamps had been placed on the streets of Manchester; comparative results obtained showed that the cost of a minimum horizontal illumination of 0·25 foot-candle per lamp per hour was 0·57d. for the 600-watt arcs, and 1·21d. for the intensified gas. The running cost per 1,000 C.P.-hours was similarly 0·75d. for the arcs, and 1·08d. for the intensified gas.

The year 1906 marked the beginning of the supersession of the single-enclosure type of lamp by magazine flame arcs, which was completed by the end of 1911.

That the amount of electric street lighting is ridiculously small, is due to the fact that up to a very recent date the Gas Committee of the Corporation has been the street-lighting authority. On October 2nd, 1912, the City Council placed the control of the lighting of the streets under the authority of a Street Lighting Committee, and it is hoped that impartial consideration will be accorded in the future to the rival illuminants.

Arising out of a proposal to extend the high-pressure gas lighting system, the City Council, on February 1st, 1911, authorised a scheme of competition between the two rival illuminants. No restrictions were placed on either department; each was to do its best.

This paper is particularly concerned with the comparative results of Princess Street and Portland Street, which may be regarded as typical examples of modern street lighting by high-pressure gas lamps and high-candle-power flame arcs respectively.

Four Keith high-pressure lamps were suspended in Princess Street at the same height above the roadway as the arc lamps, namely, 27 ft. 6 in. The distance between the lamps averaged 106 ft. 6 in. Each lamp contained three inverted burners, and clear globes were used. At normal pressure each burner was rated at 1,500 C.P., or a total of 4,500 C.P. for the complete lamp; but the maximum candle-power obtained was only about half this figure. As originally installed, the lamps were fitted with traversing and lowering gears; but these were apparently not successful, as the lamps were at a later date fixed permanently in position. The flexible gas supply tubing was also replaced by rigid galvanised gas barrel.

Princess Street is 60 ft. wide, and as the lamps were on an average only 106 ft. 6 in. apart, the resulting illumination was very good, and far superior to any previous example of high-pressure gas lighting in Manchester. Presumably in order to improve still further the maximum illuminating effect, but certainly not the uniform distribution of the light, the lamps have been lowered about a foot.

The central-suspension system was chosen for the lighting of Portland Street, and certain predetermined "units" of light were erected at such calculated distances apart as to give the maximum illumination for the least capital expenditure.

In addition to low initial costs, the central lighting system has the following advantages, which appear to outweigh certain known disadvantages:—

(*a*) The distributing mains can all be kept to one side of the street.

(*b*) No separate lighting-standards are required on the street pavements, with consequent advantage to pedestrian traffic.

(*c*) A more even illumination is obtained; in other words, the ratio of maximum to minimum illumination is less than with side lighting for a given amount of electrical power employed.

The traffic in Portland Street is of a very dense character. It was therefore deemed advisable to aim for a high standard of minimum illumination, viz., something of the order of 0·5 foot-candle.

The length of Portland Street is 1,751 ft., and its width 66 ft. Sixteen 550-watt lamps, working four in series on the 200-volt mains, have been erected; the distance between lamps varies from 114 ft. to 124 ft.

Eight of the 16 lamps are run on an all-night circuit, and the remaining eight are switched off at 11 p.m. The switching "on" and "off" is automatically controlled by time switches.

With six exceptions the arc lamps were suspended 28 ft. above the level of the street by means of two wrought-iron straps, from two steel wires of $\frac{5}{16}$ in. diameter, placed 14 in. apart, one above the other in a vertical plane (see fig. 1). Under these conditions the swinging of the span wires is largely counteracted.

The lamps are fixtures, and all trimming has to be done from a tower wagon.

From the street level to a height of some 8 ft., galvanised steel tubing is run up the building walls. The service branch cables drawn through the tubing then enter a connecting box, and from the latter a heavily sheathed 7/18 S.W.G. twin vulcanised india-rubber cable is fastened to the upper part of the walls with raw-hide cleats, and is then carried across the span wires to the lamps by means of pigskin suspenders. The lamps are of the magazine type, and the actual hours of burning average 70; but it is usual to allow only 65.

The first results obtained were not considered altogether satisfactory. Shadows and concentric rings were practically eliminated by the use of slightly opalescent outer globes, but the efficiency of the lamps was impaired to a very appreciable extent, and the distribution of light was rather worse than before.

It is apparent, from an inspection of the polar curves (fig. 2), that neither the clear nor the opalescent outer globes were suited to the conditions.

The height of the lamps was lowered from 28 ft. to 27 ft. 6 in., to mask certain shadows of the trolley-wires.

Whilst the lamps were undoubtedly giving their rated candle-power, yet, owing to the particular design of the outer opalescent globes and spinnings, practically all the rays from the horizontal to the 18° angle below the horizontal were entirely blotted out. It was decided to modify the construction of the spinnings, lowering the arc a distance of ½-in., and to use another type of outer globe in which there was less interference with the direct trans-

mission of the light rays in the neighbourhood of 20° below the horizontal (fig. 3). The alterations resulted in a substantial increase in the candle-power emitted between the angles of 10° and 20°, the maximum ray attaining 3,600 C.P. at 23°.

In the early part of 1912 the Manchester Corporation called in Mr. Jacques Abady and Mr. Haydn Harrison to report on the two systems of street illumination as carried out in Princess Street and Portland Street respectively. The reports of these gentlemen have already appeared in the technical Press.*

In order that the comparison between the various schemes of lighting might be both definite and reliable, and also to enable the best results to be obtained from the arc lamps, a very considerable amount of photometric testing was necessary. This work was in progress for over twelve months, and many thousands of readings were taken during that period.

All the testing was done in the streets at night with the lamps burning under normal conditions.

The photometer used was a modification of an instrument constructed by Messrs. Alexander Wright & Co. The photometer head is of the Simmance and Abady flicker type. This photometer measures the actual light flux density of the incident ray, from which values for candle-power and the intensity of illumination on vertical or horizontal planes can readily be calculated. The complete apparatus

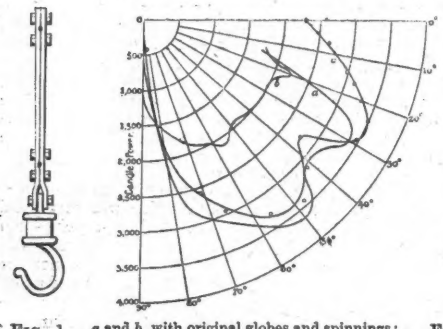

FIG. 1. *a* and *b*, with original globes and spinnings; *a*, outer globes clear; *b*, outer globes opalescent; *c*, with clear globes of the type now used.

FIG. 2.—POLAR CURVES FOR 550-WATT LAMPS.

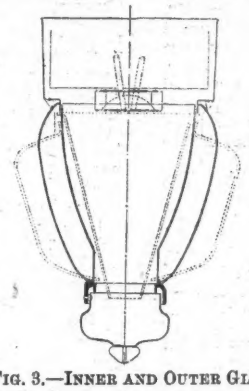

FIG. 3.—INNER AND OUTER GLOBES NOW USED. ORIGINAL SHOWN DOTTED.

is mounted on a special cart, by means of which it can be wheeled about as required. Owing to numerous structural alterations, and for no other reasons, it was not conveniently possible to arrange the photometer for taking readings at a less distance than 5 ft. from the ground.

Many of the measurements have, for purposes of comparison, been reduced to their corresponding values on a horizontal plane 3 ft. 3 in. above the ground.

Two 6-volt Osram lamps were used alternatively in the photometer as sub-standards of luminous intensity, thus providing a check on the measurements. The lamps were supplied from a 20-ampere-hour accumulator, burning when the discharge curve of voltage was practically horizontal.

In addition to photometer measurements, a few observations were also taken with a luminometer.

The results of the numerous photometric tests are given graphically in the paper. The results of street photometric tests are very frequently questioned, and gas authorities invariably dispute their accuracy. A consistently maintained degree of accuracy within a limit of 5 per cent. is all that is necessary for ordinary street work, and is recognised as sufficiently close by most of the authorities on photometric work. As all the curves obtained were plotted from the "means" of numerous readings taken with every necessary precaution, it may be reasonably assumed that the limit of possible error did not exceed 5 per cent., and, in many cases, was probably less.

The gas lamps give a much steadier light than the arc lamps, but their candle-power varies very considerably from day to day. The candle-power of a particular lamp may fall at least 50 per cent. before the mantles are renewed, unless it is arranged to change only one mantle at a time, thus spreading the complete change over a fairly long period.

The candle-power of the arc lamps may vary quite appreciably within a few minutes, but provided that the same make of carbons is used the average candle-power at any particular angle will not change to any extent from day to day, if the line voltage is reasonably constant.

A very important feature directly affecting the comfort of the general public is the absence or otherwise of glare. In this respect, the 3-burner high-pressure gas lamps have an advantage over the flame arc lamps with clear inner and outer globes. The use of clear outer globes with flame arc lamps is in fact hardly advisable from the point of view of scientific lighting.

Two noticeable features in Princess Street are the comparative softness of the shadows of objects cast on the ground and the absence of a pronounced dark horizontal zone in line with the reflectors. The first result is undoubtedly due in a great measure to the fairly large triple light source, which has the effect of shading off the edges of shadows; and the absence of a dark zone in line with the reflectors is no doubt due partly to the fact that the source of light is well below the reflector, and partly to the reflection from the inner surface of the large globes.

The shadows cast by the flame arc lamps when burning with clear inner and outer globes are very intense, and there is no appreciable shading of the edges; consequently, it is possible to confuse shadows with actual objects. The smallness of the light source, or, in other words, the high intrinsic brilliance, and the fact that the arc is well up under the reflector is no doubt the cause of the objectionable horizontal dark zone noticeable in cases where reflectors are used.

(To be concluded.)

* ELECTRICAL REVIEW, November 1st, 1912, page 693.

DISCUSSION IN LONDON.

MR. A. H. SEABROOK, in opening the discussion, said that if the London electrical engineers had had such records as those contained in the paper, 18 months ago, they would not have been troubled by competitors to the extent that they were. The figures given were conclusive. He quite agreed with the centrally-hung lamps, but did not understand the absence of lowering gear, which was a great convenience. In the case of the Oxford Street lamps, lowering gear had superseded the use of the tower wagon, and it had paid for itself in 18 months in labour saved. It was essential to use good carbons, arc lighting being the best possible advertisement for electric lighting; the authors' figure of carbon cost, '2d. per lamp per hour, was a good one, which he (the speaker) had not found it advisable to reduce. The fixed costs of £6·1 per KW. connected for lighting was a good covering figure; the estimated 70 per cent. use of lighting connection (allowed in calculating the fixed costs) seemed high. In fixing cost it should be remembered that the load was largely a non-peak one; he asked whether the figures of cost were price charged or actual cost.

MR. HAYDN HARRISON said a great deal of the work covered by the paper had been also carried out in London, but the results had not previously been published as in this case. High-pressure gas was shown to be out of court, but it was only fair to mention that the pressure was lower in Manchester than in London, and the results not so good. But a higher pressure was impossible in Manchester on account of leakage, and even with the increased pressure electricity was the better of the two. The success of the Manchester arc lighting was due to the care taken with the installation; indiscriminate arc lighting had done more harm than good. Dr. Bloch, who was an authority on the matter, gave 25·5 C.P. per cb. ft. of high-pressure gas as a practical figure, and reliable tests in this country gave 27 C.P.; the claim to 50 C P. was excessive, but the lower figures might possibly be exceeded. The Manchester street illumination suffered from the black buildings, and at the time of the test a lamp opposite a new building appeared to be the best, and would have been judged the best by the average observer, which showed the necessity of photometry. He believed the intrinsic brilliancy of the H P.-gas lamps in Regent Street was far higher than that of the arc lamps adopted in Manchester, and a great deal higher than for the arc with an obscuring globe.

PROF. SCHWARTZ said one of the great difficulties in street photometry was the large range of illumination which had to be measured: a photometer, such as that used by the authors, was liable to introduce errors due to its construction. The metre height above ground proposed for outdoor photometric measurements, was an inconvenient one, and he thought 1½ metres, or approximately the height of the eye, would be better. Tests taken by his assistants confirmed the results in the paper, and the great variation in illumination of high-pressure gas lamps. He congratulated the authors on the absence of glare; this was cheaply obtained at the cost of a little light.

MR. FRANK BAILEY thought it might be cheaper for the Manchester authorities to clean the buildings, and save energy now used in obtaining the minimum illumination. The City of London E.L. Co. had published all the principal results obtained from its experiments in street lighting, which covered much the same ground as the authors. Judging by his experience the authors had secured some curious results from dioptric globes; the latter were not easy to design, and in his own case, a special mould had to be provided before the glass-maker would make them. The treatment of the arc lamp globes at Manchester destroyed the skin of the glass, which it was difficult to preserve even in the normal state. He could not agree that arcs would not burn as steadily as gas lamps and strongly advocated further experiments with dioptric globes which would remedy such a defect.

Mr. K. EDGCUMBE said the metre height for photometric measurements had been adopted as a standard by the Germans. He thought the authors might explain a little more definitely what they meant by horizontal illumination. Illumination had nothing to do with ground surface; the figures given were presumably calculated illumination of the area covered—not necessarily Portland Street. He, however, thought the illumination should take into account the conditions due to the buildings, such as reflection, &c.

PROF. J. T. MORRIS asked whether the effect of the fog on the gas mantles was due to carbon getting in with the air, depositing on the mantle and diminishing the C P. It was regrettable that the gas lamps were not working at their highest efficiency, but high-pressure gas lamps did not give their supposed candle-power; a falling off of 25 per cent., and in some cases of 50 per cent., being

found. His own experiments confirmed the great reduction in C.P. shown by the authors. He asked whether the authors had measurements to prove the superior penetration of the arc lamps in fog, as he knew of cases where gas had been adopted owing to the statements as to the latter being superior. In looking into the question of costs, to find the direction of possible improvements, he found in the case of the arc lighting that energy cost 60-65 per cent., trimming and maintenance 7-8 per cent., and carbons 28-30 per cent., of the total, while in the case of the gas lamps, gas accounted for 80 per cent, trimming and maintenance 13 per cent., and mantles 7 per cent. of the total. It had to be remembered that the 7 per cent. was for mantles giving only half their candle-power, and if the latter were increased the life would be shortened.

MR. DOW said the nearly horizontal rays caused the glare, but they were wanted to give even illumination; the authors' globe appeared, if anything, to intensify the glare. He questioned whether any form of diffusing globe would greatly affect the illumination curve. The ideal curve could be obtained with the metal lamp; with flame arcs the light fell straight down, and the problem was to take some of it and redirect it rather than to smother it. He did not consider the colour effect would be appreciable with the order of illumination used at Manchester.

MR. A. P. TROTTER, in a communication, said the two rivals seemed to have had in view copious illumination, uniformity of distribution, and economy; if these were their objects they had both succeeded admirably. The difference between the illumination of the two streets, and between the uniformity of distribution, was imperceptible without a photometer, and the price was in favour of electricity. Until this experiment was made Manchester was, and in most of its other streets still was, the worst lighted of our great cities. Other street lighting authorities who might examine the results described, should not assume that a capital expenditure of £1,500 per mile of street, or £250 per mile per annum, was necessary for streets having the traffic of Princess Street, or even of Portland Street, after 7 p.m. The grading of the lighting to suit the requirements of the traffic in different streets, and the hours during which that traffic existed, were necessary factors in economy, unless a spectacular display was desirable for the purpose of making a town look attractive and gay. The whole of the illumination measurements might have been made with one of four or five direct-reading instruments, either at 3 ft. 3 in., or actually on the ground, with no calculations whatever. In street lighting one need not worry about the Purkinje effect, it did not begin appreciably to alter the relative brightness of red and green until the illumination had been reduced to about 0·025 ft.-candle. The authors said that their tests demonstrated a rather objectionable feature of dioptric globes, namely, the strongly-defined optical centre. But a dioptric shade generally meant one which, by the use of calculated planes and curves, so distributed the rays of light that a certain predetermined effect was produced. It was necessary to assume an initial distribution within the shade, and this implied a focus or optical centre. Dioptric shades were offered for street lighting in which no intelligence seemed to have been used in the design, and well-designed shades were so unintelligently used as to defeat the intended effect altogether. With a fixed focus arc there should be no difficulty in setting the shade as the inventor or designer intended. In 1879 he thought that uniform illumination was desirable in street lighting, but now he considered a street was more usefully lighted when the ratio of maximum to minimum was 15, or even greater. When half the lights were switched off in Portland Street, after 11 p.m., the street was excellently lighted. The graded frosting of the outer globes in Portland Street, no doubt, contributed largely to the uniformity of the lighting which had been achieved, but it was like regulating the speed of a steam engine by a brake instead of by the steam admission. There were two good features in the gas lighted Princess Street, which were well known to electrical engineers, but which had not been adopted in Portland Street. The gas lamps were surrounded by large clear globes. The large size might be necessary on account of the intense heat, but they looked well. While the maximum candle-powers were about the same, the glare looking straight at the arcs was greater in his opinion than with the gas lamps. The lesser glare of the gas seemed to be due to the use of a white reflector. If large white reflectors were used with the arcs the glare would be reduced, although the reflectors would be of little use in the sense of reflectors.

MR. S. L. PEARCE, in replying, pointed out that there was no power to attach to buildings in Manchester, and although consent to the fixing of rosettes was obtained, the fixing of winches was objected to. The cost given in the appendix included nothing for profit, but it was ample, and some items, having nothing to do with street lighting, might be omitted. The business lighting load in Manchester was a high percentage of the total, and he did not think the 70 per cent. referred to by Mr. Seabrook was too high. The standard of illumination was high, but he considered that it could be fully maintained all night with advantage. He could not recall any very detailed information having been published in regard to the lighting in the City of London; Mr. Bailey had a preference for dioptric globes, while in Manchester they preferred graded globes, and did not find their life shortened by the treatment given. In regard to candle-power per cb. ft., he was under the impression that leading gas authorities did not claim more than 40 C.P. at the present time.

MR. RATCLIFF, who also briefly replied, said the horizontal illumination they had in mind was the impressed light, not reflected light. Careful observation had confirmed the superiority of the arc lamps in a fog.

DISCUSSION AT MANCHESTER.

DR. E. ROSENBERG said that, seeing Mosley Street and Portland Street, one had the clear impression that there was competition between the Gas and Electricity Committees. In both systems there was by no means an absence of glare, and one was quite as bad as the other. It was as if the illumination problem was in its infancy, and nothing was known about illuminating streets and houses. In Manchester one could see the lamps but not the motor-cars. He considered the photometer was used too much, as it only showed what the eye saw.

MR. ALDERMAN WALKER said that the paper would have the effect of making electrical authorities assert themselves more in this matter. Regarding foggy weather, in Portland Street with its lamps spaced a greater distance apart than the gas lamps in Princess Street the lighting was infinitely better, under the actual conditions. He asked the authors if they had taken into account the quantity of low-pressure gas used as a by-pass for the high-pressure gas. In Westminster, he understood, it worked out at about 4s. per lamp per annum.

MR. H. R. BURNETT said the figures given for trimming and maintenance were remarkably low and required a little explanation. The cost per mile of street per annum was given as £254; it should be remembered that this figure did not include any capital charges, and was only for the lamps to 11 p.m. If the capital charges were added the cost of this lighting amounted to £500 per mile of street. He thought ·5 ft.-candle was too high a minimum illumination. If the main streets were lighted to this standard, the illumination of the side streets running into them must be raised also. The figure of 8½ per cent. on capital charges appeared to be inadequate.

MR. A. ANGOLD said he did not think the raising of the fittings ⅜ in. produced all the improvement, the change from one globe to another had a lot to do with it. He explained how the globe had the effect of diffusing a light and boosting the light up at the angles of 15° and 20. The glass, although clear, had considerable reflecting power; the beam thrown by the inner globe was on the 20° line, and that from the outer globe along the 15° line. About the question of glare from the full line globes shown in fig. 3, this would not be very noticeable if looked at anywhere from 35° upwards to the horizontal, because of the fact that so much light was coming from the surface of the globe. The graded frosting was a very good idea, but he did not think it would be permanently satisfactory, because all frosted globes tended to take up dirt, and the frosting spoilt the effect of reflection along the 30° line.

DR. T. Z. ZETTELL said that it was only recently that the design of arc-lamp globes had been given serious attention, and an endeavour made to design them scientifically. He asked whether any special notice was taken of the state of the globes when the tests were made; experiments had shown that a great difference could be found in candle-power figures when taken with clean and dirty globes.

MR. E. H. HOLLINGSWORTH said he had had to abandon arc lamps in favour of metallic-filament lighting, principally for the reasons mentioned by Mr. Burnett. In the old days arc lamps had to be placed 80 yards apart, and the lighting was very unsatisfactory midway between the lamps; metal-filament lamps of 200 C.P. were now fixed on each tramway standard, and the lighting was very satisfactory.

MR. H. T. WILKINSON did not think that the system of overhead suspension was used in England as much as it should be. On the Continent it was used much more freely. He could not understand why anyone trying to do his best should choose such an unsuitable street as Portland Street.

MR. A. A. KOPPEL said the arc lamps in Portland Street were too brilliant; they might be useful for advertising purposes, but were unsuitable for street lighting. Yellow flame arc lamps should not be used for street lighting. For equal distribution of light and for reducing the dark shadows complained of by the authors, three 200-watt metal-filament lamps in a single fitting would be more suitable. It would be worth the experiment to have units of 3,000 to 4,000 C.P. at 100 ft. from the ground, with special reflectors, and suitably spaced.

MR. R. G. CUNLIFFE said that, walking fairly often amongst the streets mentioned, anyone watching the lighting effects had been able to notice very quick differences in the shades, and often at close intervals, places which had been in shade had later on been well illuminated. Looking towards the gas lamps, and then up Portland Street, there was very little difference to the eye, whatever the photometer might show. Dr. Rosenberg referred to the question of glare, but those who had to drive in these streets spoke very highly of the illumination as against the side lighting. In Piccadilly, on the island platforms the centre lights were gas lamps with single mantles, which were very brilliant, but the glare was very objectionable to the people on the top of the tramcars.

MR. A. WILKINSON was of the opinion that the new type of globe used had a fixed focal point, and in fitting these globes to the spinnings, care must be used; if in drawing up the net wires one side were pulled tighter than the opposite side, the globe would be canted out of the centre line. This would alter the angle at which the light rays struck the inner surface of the globe, the resulting effect being to deflect the rays on one side upwards, and on the opposite side downwards; and as the 40° to 80° rays were entirely reflected ones, it was important that they should not be distorted. If possible globes should be made with necks, having a more mechanical support than nets. With the type of lamp used in Portland Street, the carbons were fed alternately to the right and left of the vertical centre line of the lamp and its globe; thus the arc was burning out of centre some ¼ in., the shadow of the lower finial was projected on the ground in an eccentric manner relative to the centre line of the lamp and ground, and on the arc changing over to the incoming carbons, the shadow was projected on to the

other side of the centre line. As this change took place every five hours, it was a difficult matter to design a reflector which would blot it out entirely.

Mr. P. P. Wheelwright said that in these days when main streets were very much more like railway tracks than roads, the more spent to good advantage on the lighting of streets, the safer were the roads. The colour of the flame arc was attractive to the public, and in the streets of Lancashire towns lighting was a valuable asset. In Blackburn people came from all the villages around for shopping, and the more attractive the streets were made, the more they would come.

Mr. Jackson, referring to the low-pressure gas used for the by-pass, said it was a curious fact that gas people always did neglect this point. In some cases it worked out to 10s. per lamp per annum. To compete with high-pressure gas lighting by metallic-filament lamps would result in failure, and the only way to attain complete success was by using flame arc lamps. The maintenance charge given in the paper, not only with regard to the electric lighting, but also the gas, 0·5d. per lamp, worked out at 150 lamps per man; no one man could look after 150 flame arc lamps. A figure of 27s. 2d. per lamp per annum was quoted for the maintenance charges for gas lamps—in the case of ordinary gas lamps he calculated 17s. per lamp, and in street gas lamps the gas people charged 30s. per lamp per annum, but he thought those charges should be increased by at least 50 per cent.

Mr. S. L. Pearce, in reply, said with regard to Dr. Rosenberg's remarks, that there was not a very high value of illumination in Portland Street, and at present he did not consider that they had carried out their experiments to a final conclusion in regard to getting over the glare. They were not satisfied that the best results had yet been obtained. He thought there was nothing included for the gas used for the by-pass in the figures which were returned by the gas department. The maintenance cost was borne out in practice, probably because Portland Street was very near Dickinson Street station, and consequently very little time was lost in going to and fro. He did not agree with Mr. Burnett and other speakers that there was too high a standard of lighting in Portland Street, and that it was too expensive. Those who resided in Manchester knew how extremely difficult the traffic was, especially between 4.30 and 6.30 in the evening. A most valuable report which had recently been issued by the tramways department, referred to the loss of the tramways due to drawing up on account of the congestion of the streets in the central area. This was possibly due to the fact that the illumination in the important thoroughfares was very poor, and the tramway traffic was often held up for this cause also. It seemed to him that the tramway authorities would very much reduce the energy consumption per car-mile if the illumination in the streets of Manchester was improved. He was surprised to hear Mr. Burnett's remark that on lower standards of illumination metallic-filament lamps were cheaper than flame arcs. For street lighting the tendency all over the kingdom to-day was for higher candle-power, and therefore the tendency would be to go in for flame arc lamps instead of metallic-filament lamps. In reply to Mr. Jackson, there was no doubt that the gas figures had all been based on laboratory tests, and they would not deny that under certain perfect conditions it was possible to get 60 C.P. per cb. ft. of gas per hr., but the figure had been used in a somewhat unwarrantable fashion. Only lately Mr. Frank Goodenough had reduced this figure from 60 to 40. He thought it absurd, even assuming that a single mantle gave 1,500 C.P., to assert that 4,500 C.P. was obtained from three mantles in the same lamp, as there must be some masking effect.

Mr. Ratcliff, in reply to Mr. Angold's remarks regarding the 20° ray of light, said the tests did show that they got something of that sort, and also they got a beam of light at a lower angle which was utilised in another direction by means of the globes. It was the beam of light at the lower angle which the eye saw, and they tried to remedy it by using a special globe and got two advantages—it cut off the light they did not want, and the deflection improved the distribution in the direction where it was required. The gas lamps were cleaned for all the tests, and the electric lamp globes on the average were fairly clean. There was not any apparent difference between the illumination in Portland Street and Mosley Street, as the order of illumination was only about 0·5 to 0·4. These results were actually confirmed by the independent experts.

NEW PATENTS APPLIED FOR, 1913.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

5,285. "Electrically-heated apparatus." E. C. R. Marks. (Landers, Frary & Clark, United States.) March 3rd. (Complete.)

5,290. "Ignition of internal-combustion engines." J. E. Wilks. March 3rd. (Complete.)

5,295. "Systems and apparatus for electrically controlling a group of railway switches or signals." A. E. Alexander. (Union Switch and Signal Co., United States.) March 3rd. (Complete.)

5,307. "Electrical resonance apparatus." H. W. Handcock, A. H. Dykes and W. Duddell. (Divided application on 6,716, 1912, March 19th.) March 3rd.

5,321. "Actuating devices for circuit closures." G. D. Young. (Convention date, March 29th, 1912, United States.) March 3rd. (Complete.)

5,352. "Electro-magnetically controlled perforating apparatus." B. Soldatencow. (Addition to 14,658, 1911. Convention date, March 16th, 1912, France.) March 3rd. (Complete.)

5,365. "Ignition apparatus." O. Schlick. (Convention date, March 5th, 1912, Germany.) March 3rd. (Complete.)

5,411. "Regulation of dynamo-electric machines." British Thomson-Houston Co., Ltd., and N. Shuttleworth. March 4th.

5,421. "Electric signal transmitters." G. H. Oatway. March 4th.

5,448. "Vapour electric devices." British Thomson-Houston Co., Ltd. (General Electric Co., United States.) March 4th.

5,458. "Telephone receiving apparatus." R. Hopkins. March 4th.

5,463. "Electrically-operated winding gear for clocks and the like." L. J. Aron and C. H. Harrison. March 4th.

5,481. "Arrangement for starting groups of electrical machines consisting of a synchronous and an asynchronous machine connected in cascade with it." W. P. Thompson. (Ateliers de Constructions Electrique de Charleroi, Belgium.) (Addition to 7135/12.) March 5th. (Complete.)

5,483. "Electric arc lamps." W. R. Ridings. March 5th.

5,491. "Anti-vibration supports for incandescent electric lamps." A. Bcon and H. T. Wilkinson. March 5th.

5,510. "Method of and apparatus for starting the operation of an electric furnace for producing metallic powders." M. U. Schoop. (Convention date, March 8th, 1912, France.) March 5th. (Complete.)

5,523. "Electric fuse plugs." British Thomson-Houston Co. (Allgemeine Elektricitäts Ges., Germany.) March 5th.

5,529. "Continuous-current reducing brake connection with regulation by resistances in parallel with the motor armature." Allgemeine Elektricitats Ges. (Convention date, March 5th, 1912, Germany.) March 5th. (Complete.)

5,532. "Distributor for electric ignition in internal-combustion engines." R. Bosch (firm of). (Addition to 9,840/11. Convention date, April 12th, 1912, Germany.) March 5th. (Complete.)

5,537. "Electric signalling systems." Sir A. T. Dawson and G. T. Buckham. March 5th.

5,544. "Control or actuation of clocks and other indicating and recording mechanism by wireless or other waves." E. V. Gratze. March 5th. (Complete.)

5,545. "Electric storage system." C. F. Kettering. (Divided application on 3,794/12, February, 1912. Convention date, May 22nd, 1911, United States.) March 5th. (Complete.)

5,546. "Automatic electric switches." H. C. E. Boutard. (Convention date, March 6th, 1912, Denmark.) March 5th. (Complete.)

5,549. "Methods of detecting high-frequency oscillations." E. C. Young. March 5th.

5,568. "Gas-detecting apparatus for portable electric hand-lamps." G. J. Ralph. March 6th.

5,579. "Emergency magnetic and spring cut-off device." B. T. Phillips and D. J. Phillips. March 6th.

5,593. "Device for indicating failure of an electric lamp." H. H. Chapman, E. J. Deane and F. M. Barton. March 6th.

5,599. "Electrical signs for advertising purposes." A. L. Preece. March 6th.

5,626. "Electrical annunciators." British L. M. Ericsson Manufacturing Co., Ltd., and A. G. Rogers. March 6th. (Complete.)

5,637. "Electrical advertising signs, devices or the like." L. Martin and G. Nixey. March 6th.

5,644. "Secondary batteries or accumulators." F. J. Wood. March 6th.

5,646. "Electric pocket lamp with compass." Elektromechanische Industrie G.m.b.H. (Convention date, November 22nd, 1912, Germany.) March 6th. (Complete.)

5,648. "Electrical order-transmitting systems and the like." E. A. Graham and W. J. Rickets. March 6th. (Complete.)

5,653. "Machine telephone switching systems." Western Electric Co., Ltd. (Western Electric Co., United States.) March 6th.

5,654. "Telephone exchange systems." Western Electric Co., Ltd. (Western Electric Co., Belgium.) March 6th. (Complete.)

5,662. "Protective devices for electric circuits." E. E. F. Creighton. (Convention date, May 2nd, 1912, United States.) March 6th. (Complete.)

5,726. "Electric meters." G. North. March 7th.

5,727. "Alternating-current electric meters." G. North and T. W. Rose. March 7th.

5,734. "Electric registering devices." British Thomson-Houston Co., Ltd. (Allgemeine Elektricitäts Ges., Germany.) March 7th.

5,735. "Dynamo-electric machines." British Thomson-Houston Co., Ltd. (General Electric Co., United States.) March 7th.

5,745. "Brush and sparking plug cleaner." E. Swinney. March 8th.

5,748. "Potential regulators for over-compounding or level-compounding on alternating-current systems." A. M. Taylor. March 8th.

5,763. "Method of electrically governing the speed of engines at sea." A. W. Fithian. March 8th.

5,792. "Circuit controller." W. Morrison. (Convention date, January 15th, 1913, United States.) March 8th. (Complete.)

5,802. "Telephone receiver supports." F. S. Maxwell. March 8th. (Complete.)

5,805. "Telegraphic transmitters." W. S. Stelljes and Rebesi, Ltd. March 8th.

5,830. "Voltage regulation of alternating-current circuits." H. M. Taylor, R. H. Scotson and E. Cox-Walker. March 8th.

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of Messrs. W. P. Thompson & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1912.

Appliances or Means for Mounting Incandescent Electric Lamps and Reflectors therefor. A. W. Beuttell. 1,186. January 15th.

Electrically-operated Doors. G. Korytowski. 3,736. February 14th.

Apparatus for Transmitting Automatically to a Distance Indications of the Operative Positions of Devices. A. G. Bloxam. (Russische Akt.-Ges. L.M. Ericsson & Co.) 3,742. February 14th.

Electrical Installations for Lighting, Heating and Ventilating Railway Carriages and for Similar Purposes. J. Stone & Co. and A. H. Darker. 4,073. February 17th.

Electrically-heated Cooking Utensils. W. F. Perry. 4,090. February 19th.

Regulation of the Speed of Electrically-driven Ring-spinning Machines. J. Kemmerich. 4,240. February 19th. (February 18th, 1911.)

Dynamo-electric Machines of the Homopolar Type. British Thomson-Houston Co. (Noeggerath.) 4,187. February 19th.

Sockets or Bases of Trolley Poles for Electric Traction Systems. E. M. Munro and R.E.T. Construction Co. 4,264. February 20th.

Regulation of the Speed of Electrically-driven Ring-spinning Machines. J. Kemmerich. 4,590. February 23rd. (August 19th, 1911. Addition to No. 4,140 of 1912.)

Brush Holders for Dynamo-electric Generators or Electric Motors. Morgan Crucible Co. and J. E. Grant. 4,592. February 23rd.